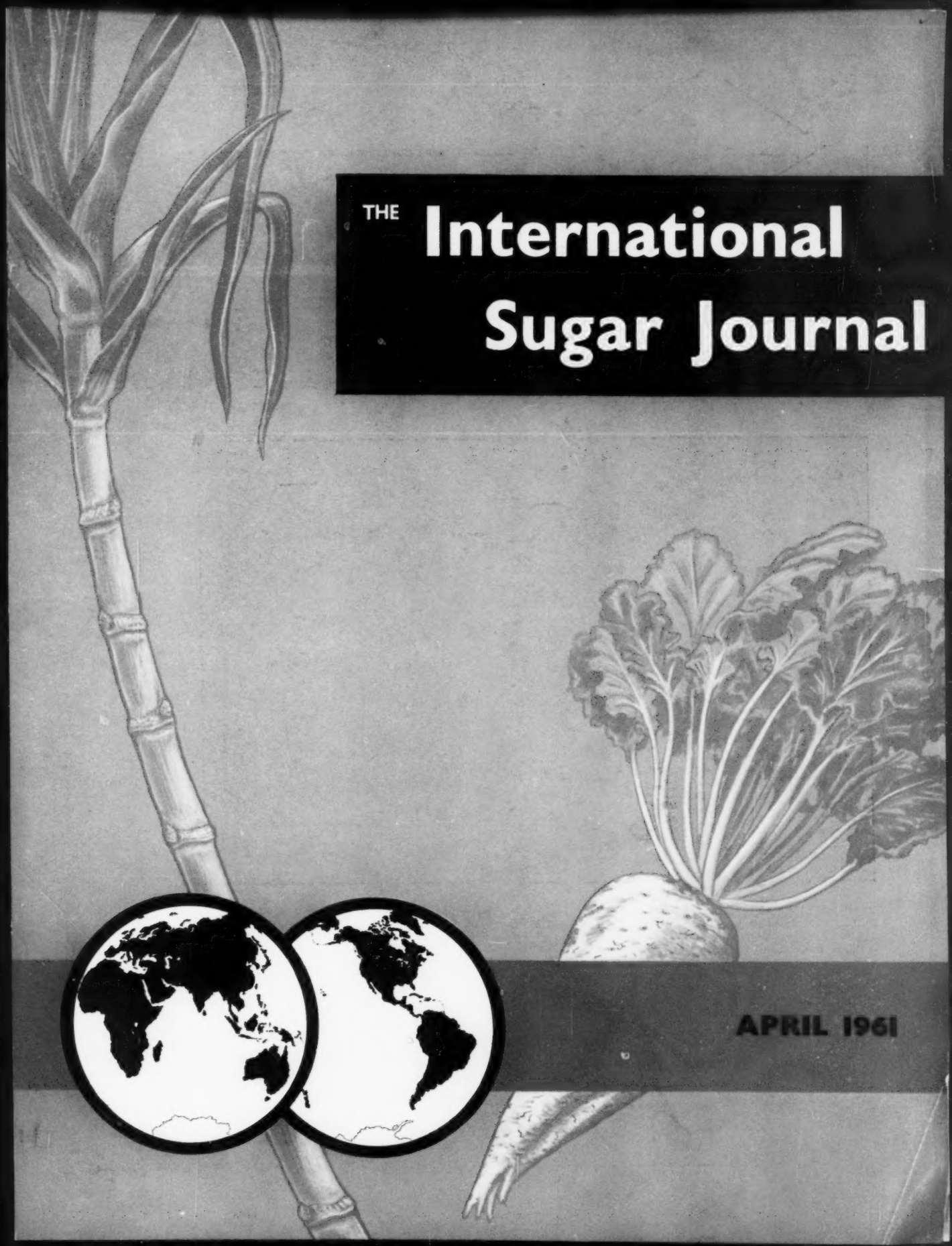


THE International Sugar Journal

APRIL 1961

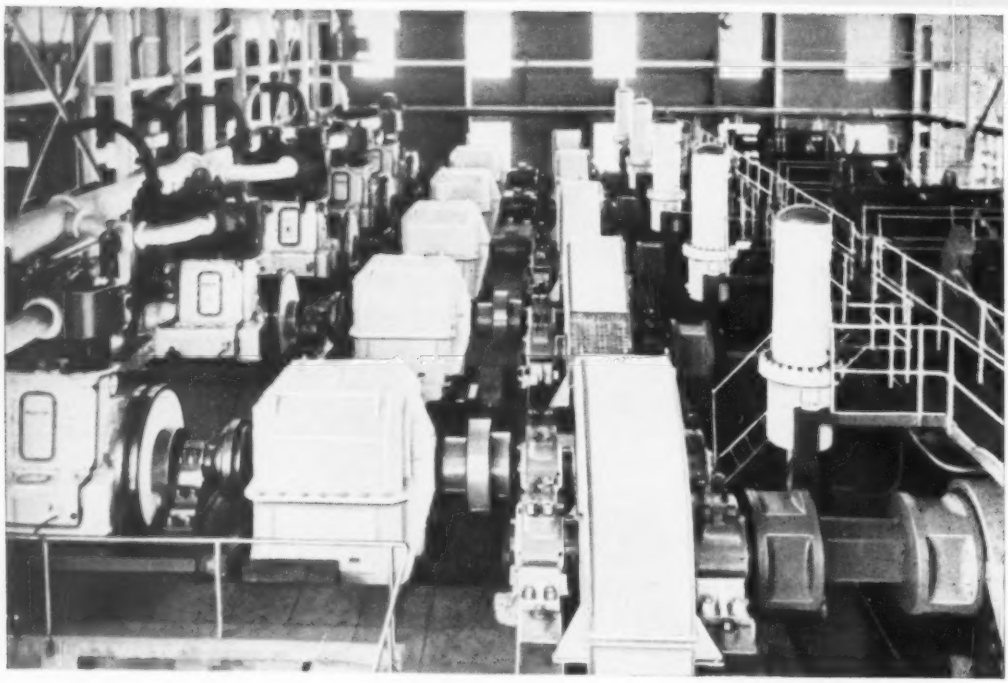
BLAIRS

COMPLETE

SUGAR

FACTORIES & REFINERIES

DISTILLERIES, ABSOLUTE ALCOHOL & CHEMICAL PLANTS



18-roller Milling Plant recently completed in Natal, South Africa, crushing about 5,000 tons of Cane per 24 hours, and comprising One 44 in. x 84 in. 3-roller crusher, Searby shredder, and Five 42 in. x 84 in. 3-roller mills. Crusher and each mill driven by an independent high-speed engine of 600 b.h.p. through totally enclosed gearing. Shredder by direct drive electric motor.

(Photograph by courtesy of Sir J. L. Hulett & Sons).

BLAIRS LIMITED

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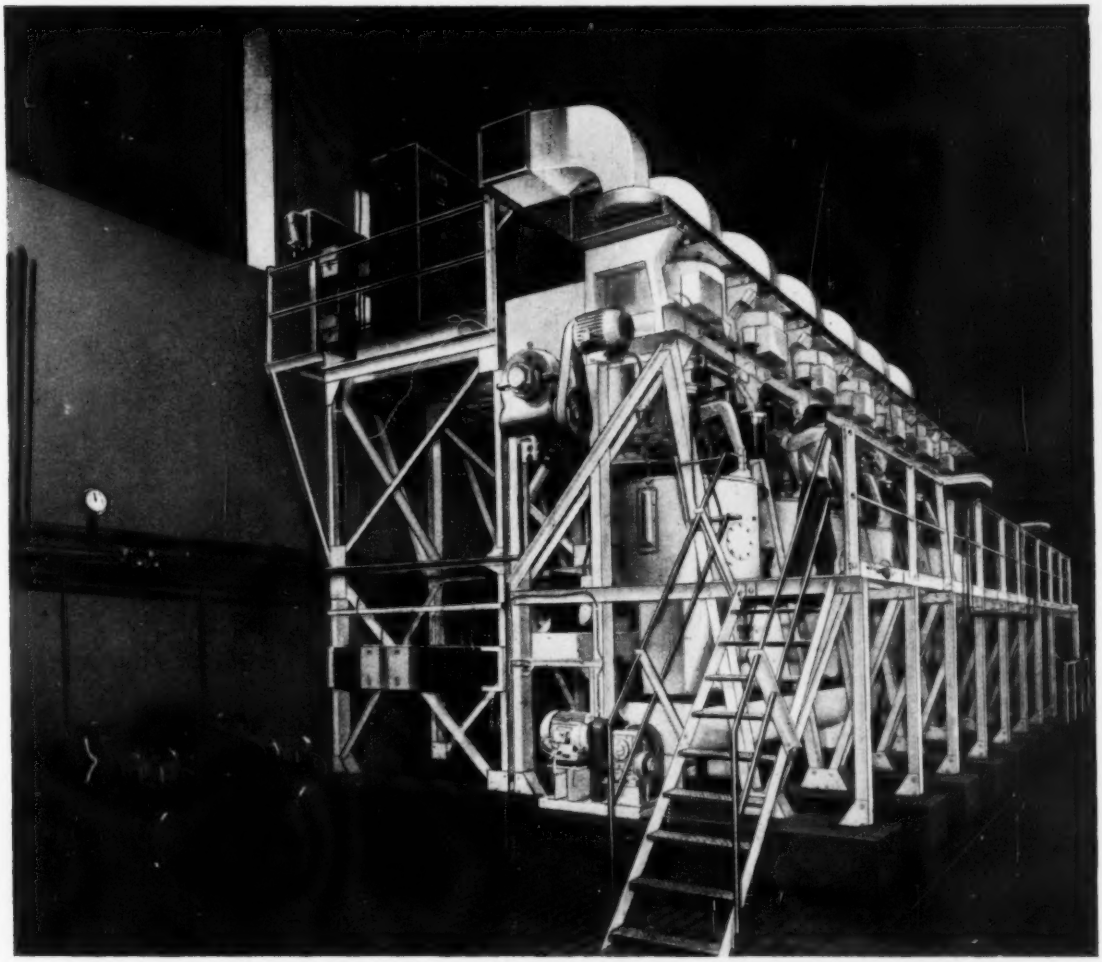
Cable — "BLAZON GLASGOW"

LONDON OFFICE — 14 GROSVENOR GARDENS, S.W.1 Cable — "MULTIVAP SOWEST LONDON"



A battery of seven Broadbent Sugar Centrifugals installed at Sir J. L. Hulett's Darnall Factory, South Africa.

CENTRAL AND SOUTH AFRICA

A total of 64 Broadbent Sugar Centrifugals were supplied to Central and South Africa for the 1960 campaign, bringing the number installed in the area since 1954 to 229 machines.

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THOMAS BROADBENT & SONS LTD CENTRAL IRONWORKS . HUDDERSFIELD . ENGLAND

The World's largest manufacturer concentrating entirely on industrial centrifugals

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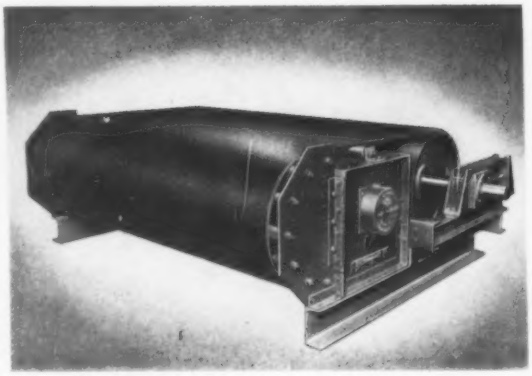
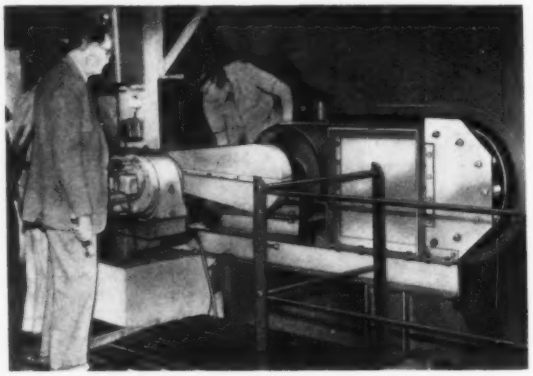
MAGNETIC CONVEYOR HEAD



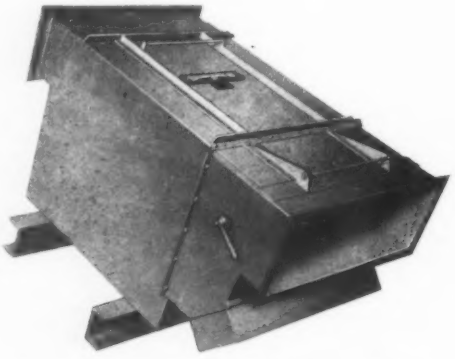
Boxmag patent MH. 2484. Conveyor Head built into an 84" wide short belt conveyor, photographed prior to despatch. The machine is designed for installation, as shown on the adjacent illustration.



Boxmag patent MH. 2484 installed in the chute between a sugar cane carrier and crusher, at a factory in Mauritius. It is designed to remove tramp metal automatically and continuously without an operator's attention. (write for leaflet 62/2).

MAGNETIC SEPARATORS PROTECT MACHINERY AND PRODUCTS

(Write for further details)



Boxmag Superflux Magnetic Chute for removal of ferrous contamination from refined sugar to decontaminate the product.

A Boxmag Unimajor block type Permanent Magnet. One of the many types of separators suitable for general applications in sugar factories. (write for details of full range).

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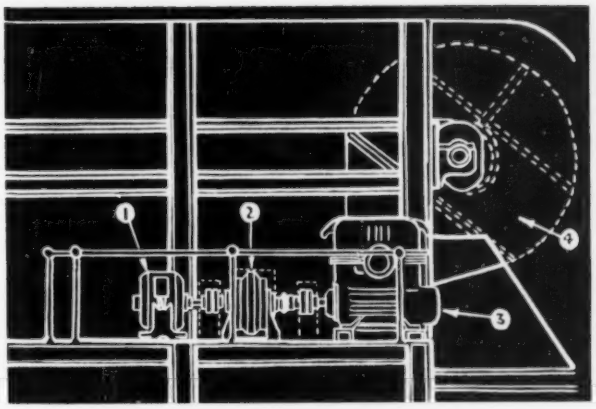
Mirrlees'

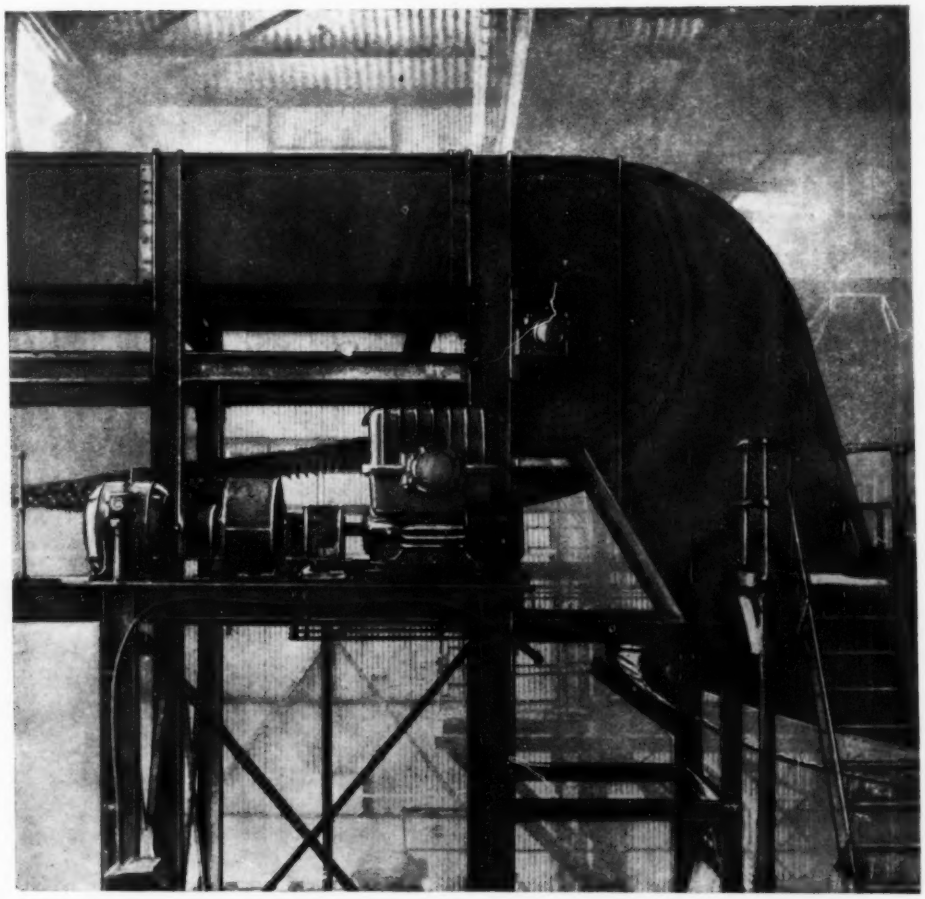
CANE CARRIER DRIVE

BY CONSTANT SPEED ELECTRIC MOTOR



On the above diagram,

1. Squirrel cage motor.
2. Variable speed constant magnetic coupling.
3. Worm reduction gear box.
4. Spur gear.



Cane Carrier Drive installed in the Gal Oya Factory, Ceylon.

In this improved drive for Cane Carriers, the eectronically controlled coupling gives smooth shockless starting, variable surface speed for close control of cane feed and prevents cane knife chokes. The drive employs a compact reduction gear and standard squirrel cage motors and starters.

THE MIRRLEES WATSON COMPANY LIMITED

HEAD OFFICE AND WORKS—45 SCOTLAND ST., GLASGOW, SCOTLAND. TELEGRAMS "MIRRLEES GLASGOW"
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The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive

This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 h.p. *Shipping weight : 14 cwts.*

Manufactured in Great Britain by :

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BEET SLICING
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AUTOMATIC KNIFE SHARPENING MACHINES

AS SUPPLIED TO
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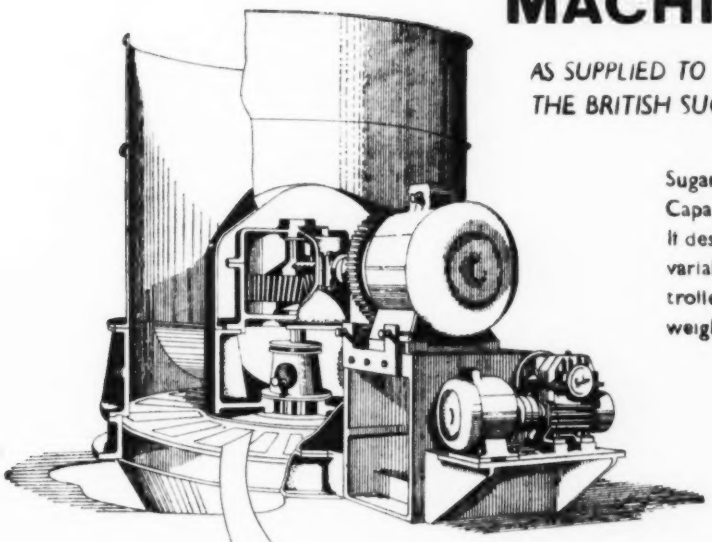
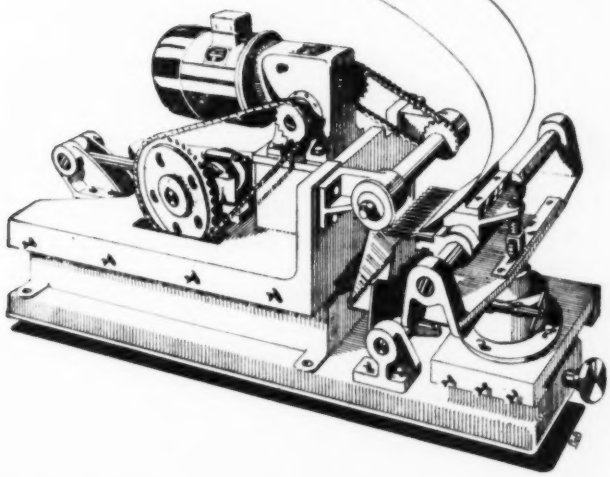


Sugar Beet Slicing Machine. Capacity 1,200 tons/24 hrs. If desired can be fitted with variable speed drive controlled by cossette band weigher.

Automatic Knife Sharpening Machine for coarse and fine sharpening.



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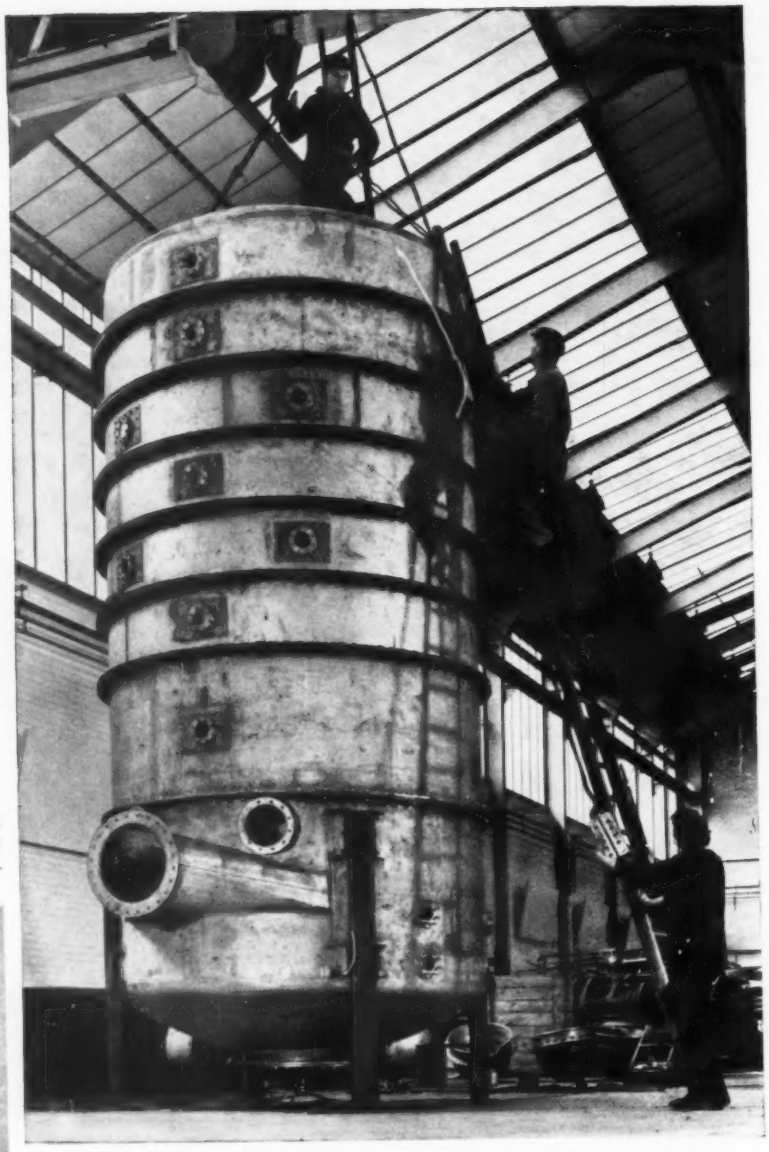
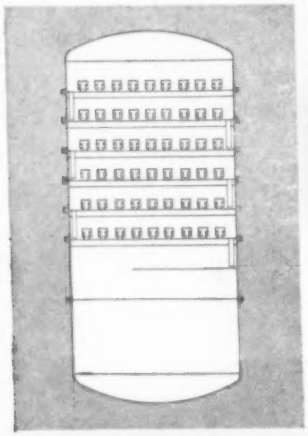
OF HULL



STAINLESS STEEL ABSORPTION COLUMN 8' DIAMETER 26' OVERALL HEIGHT



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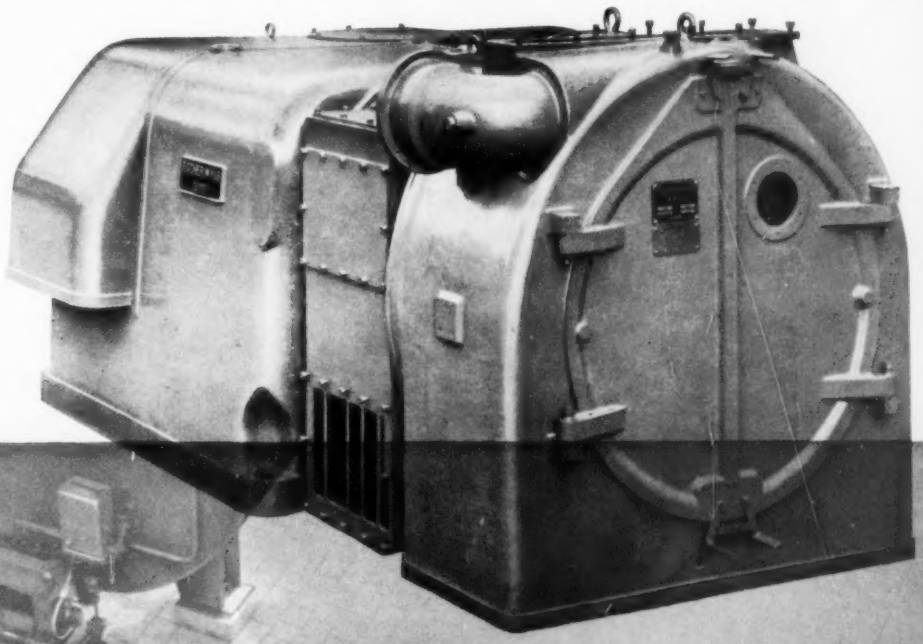
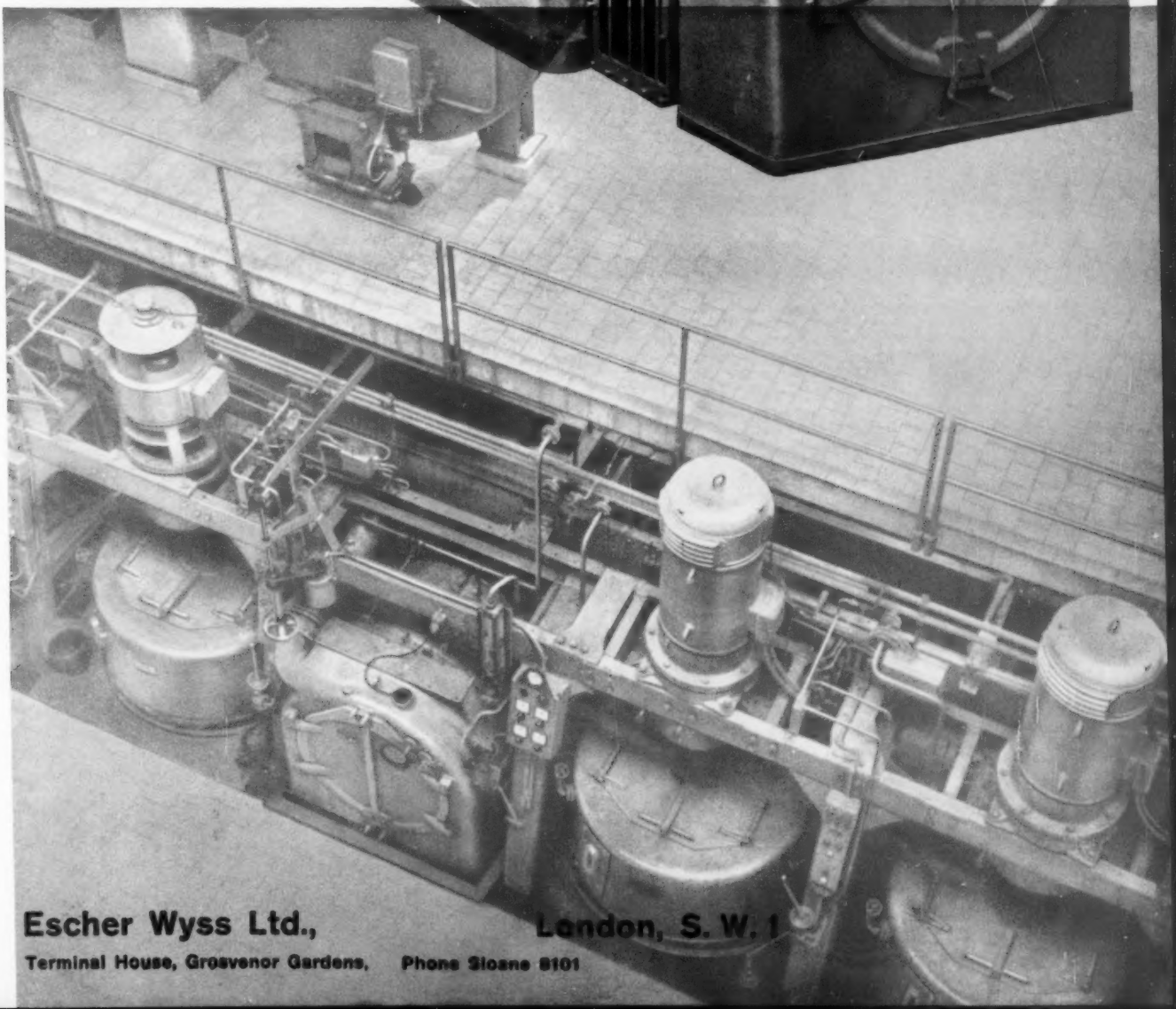
ESCHER WYSS

continuous centrifuges for the sugar industry

These centrifuges are in operation at Sugar Factories throughout the world.



Escher Wyss Centrifuge as replacement in a battery of vertical machines.

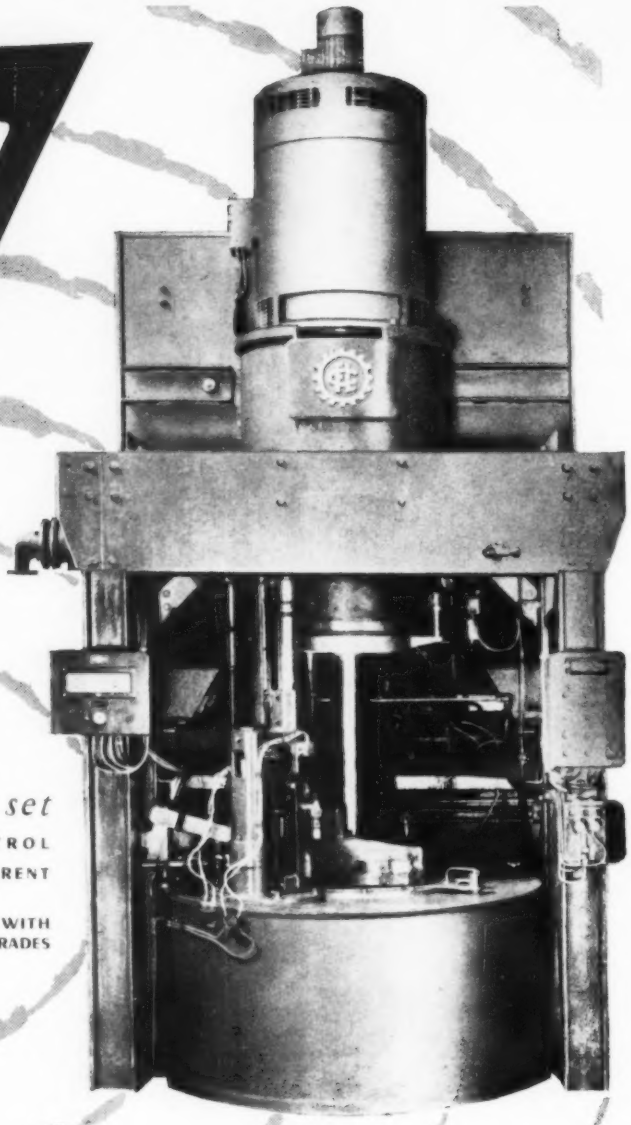


Escher Wyss Ltd., **London, S. W. 1**

Terminal House, Grosvenor Gardens. **Phone Sloane 9101**

Fully automatic!

the new CENTRIFUGAL



driven by
WARD-LEONARD *set*

- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
- RECORD PRODUCTION WITH MASSECUITES OF ALL GRADES

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)

S.A.G. - PARIS

FIVES LILLE - CAIL

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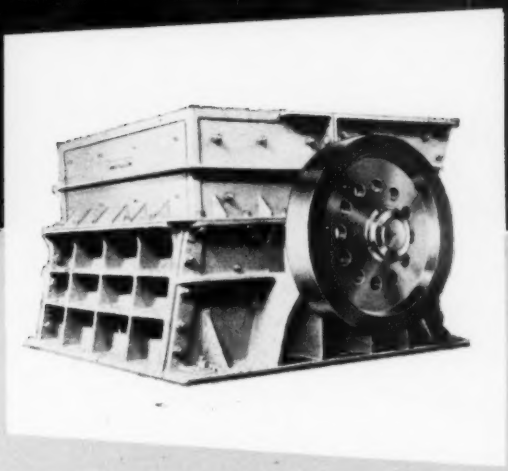
THE GRUENDLER CANE SHREDDING PROCESS gives top performance ALL THE WAY . . . all over the world



- It increases sucrose extraction
- It increases capacity
- It lengthens roll life
- It produces better bagasse for fuel or paper-making
- And an additional and vital feature: . . . the design, engineering and construction of the Gruendler Cane Shredder prevents tramp metal from entering mill rolls where severe damage and costly shut-downs would result.

AN UNSOLICITED TESTIMONIAL IN GRUENDLER'S FILES STATES THE FOLLOWING:

"Because the shredder gives such a loud warning when tramp metal enters, the operator can remove the obstacle before it enters the mill tandem. We can sleep at night due to the elimination of worry from this score. If the shredder did nothing more than extract the iron from the mill we feel that this alone has paid for the entire shredder installation."

These men are holding a 190-lb tyne from a crane grab that entered a Gruendler Shredder at Evan Hall Sugar Cooperative in Donaldsonville, La., U.S.A., but did not enter the mill! Mill maintenance is greatly reduced by the elimination of tramp iron such as this, which is very important in cane milling.

Photo shows an accumulation of tramp iron that entered the Gruendler Shredder at a mill in Peru. Any of these pieces could have been responsible for a long and costly shut-down of the mill.

IT'S GOOD BUSINESS TO ADOPT THE GRUENDLER CANE SHREDDING PROCESS

GRUENDLER CRUSHER & PULVERIZER CO.

ESTABLISHED 1885

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Leo Freeman, V.P. Sugar Mill Div.
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MANUFACTURERS OF SHOCK GRAIN PULVERIZERS, CANE TRASH DISINTEGRATORS, BAGASSE CLEANER AND FILTER AID, BALE BREAKERS, ELEVATING AND CONVEYING EQUIPMENT

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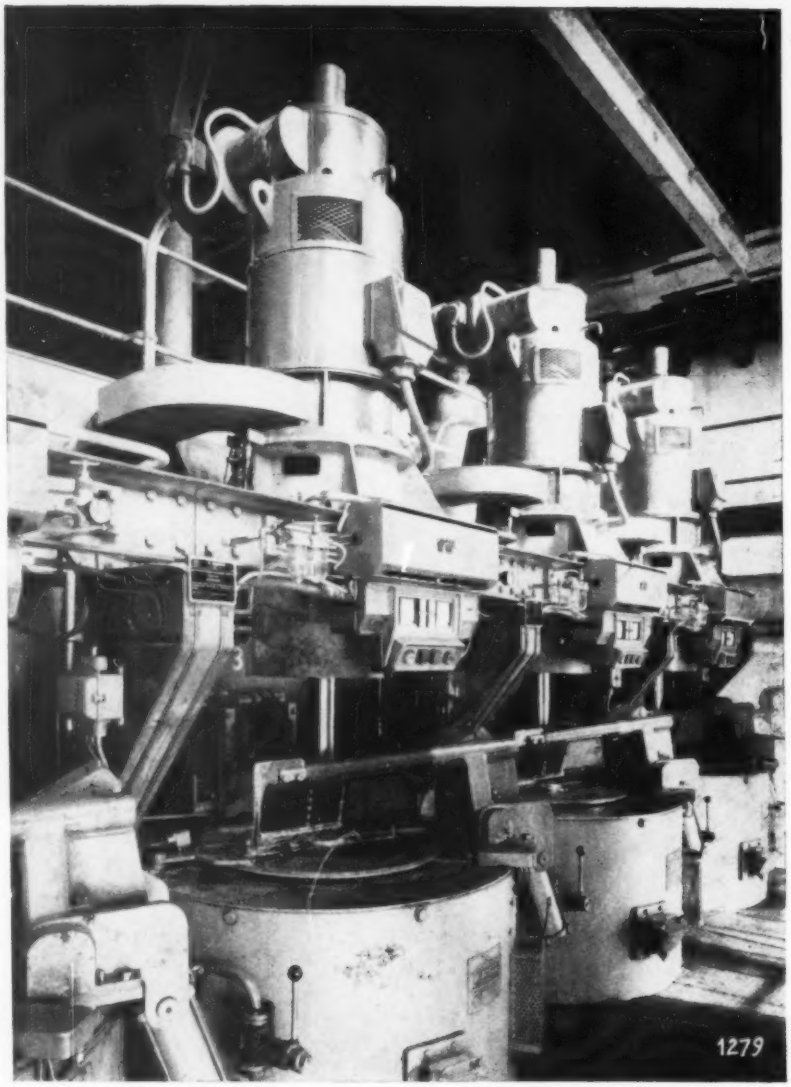


FULLY AUTOMATIC SUGAR CENTRIFUGALS

Type	*Basket D × H*	*Basket cross section*	*Massecuite Max. Charge*	*Performances*		
				Mod.	*Max. sp. r.p.m.*	*Cycles per hr.*
"SCARA. U"	1250 × 830 mm.	Cylindrical with truncated cone shaped bottom	500 kg.	Normal	1000	30
				Velox	1500	25
"SCAME. P"	1050 × 585 mm.	Cylindrical with flat bottom	350 kg	Normal	1500	20
				Velox	1800	10
"SCAME. G"	1220 × 762 mm.	Cylindrical with flat bottom	650 kg.	Normal	1000	25
				Velox	1500	20

BOSCO TERNI

Officine Meccaniche e Fonderie

A. BOSCO

TERNI ITALY

More than 500

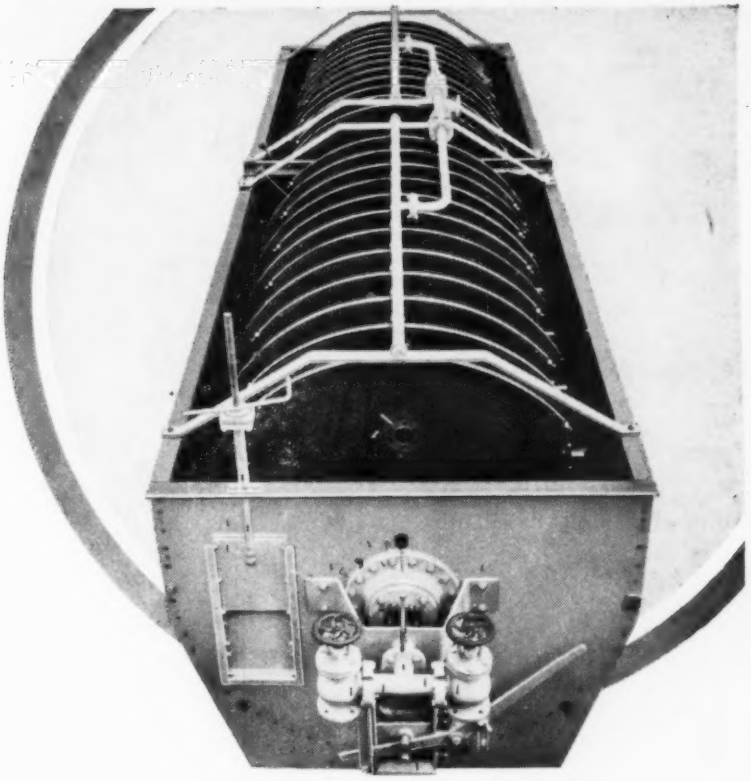
WERKSPOOR

Rapid

Crystallizers

in use in

sugar factories



Applications for high grade as well as for LOW GRADE massecuites!

Licensees for the manufacturing of Werkspoor Rapid Crystallizers:

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Paris - France

Honolulu Iron Works Co. Inc.
Honolulu - Hawaiian Islands

Honolulu Iron Works Co. Inc.
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London - Great Britain

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San Juan - Puerto Rico

WERKSPOOR

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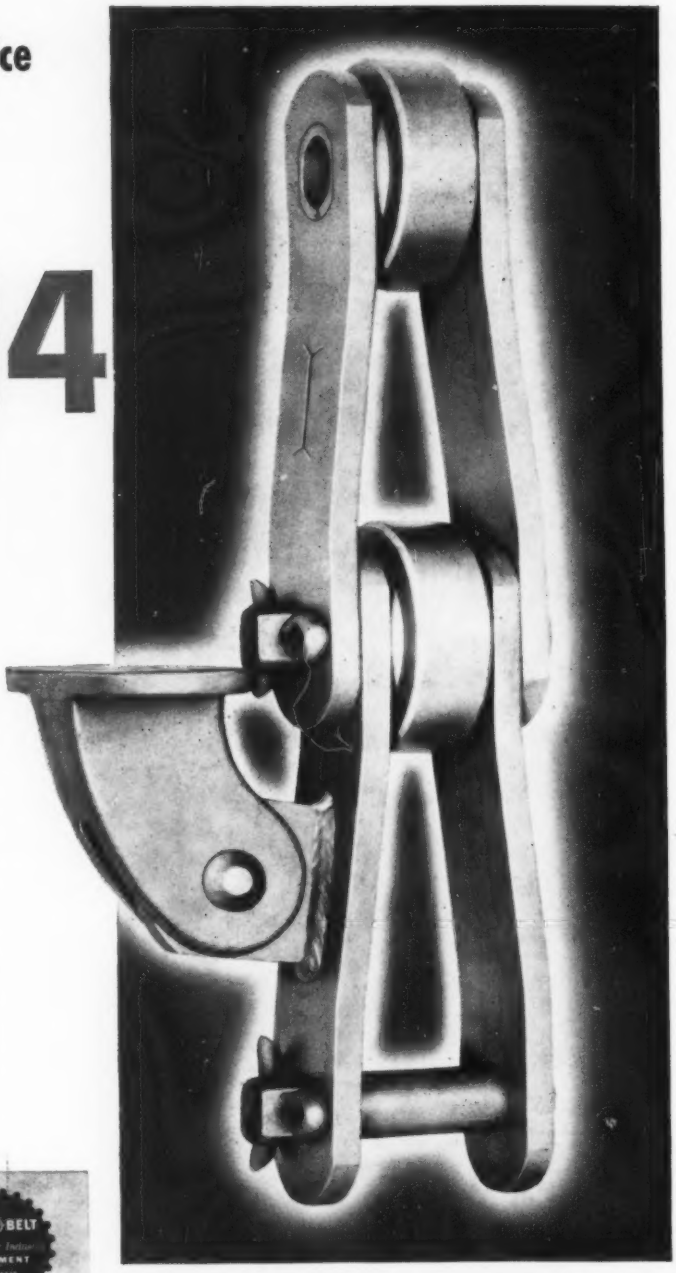
For bagasse carrier service modern mills specify

LINK-BELT SS-2184 PLUS CHAIN



Exceptional strength and durability make Link-Belt SS-2184 Plus chain the choice for long, heavy-duty conveyors that reclaim and deliver bagasse to storage and boilers.

Use of selected steels plus controlled manufacture and assembly of parts result in increased life . . . reduced replacements and maintenance. When replacement becomes necessary, individual links with offset sidebars permit fast, easy removal.

What's more a wide range of SS class chains are available to permit the selection of the right chain to suit all bagasse carriers.

You can standardize on Link-Belt for all your drive and conveying needs. For example, Link-Belt Class 1100 malleable or Promal chains are ideal for shorter center bagasse carriers and ligher loads. For full facts, call your Link-Belt representative or write direct.

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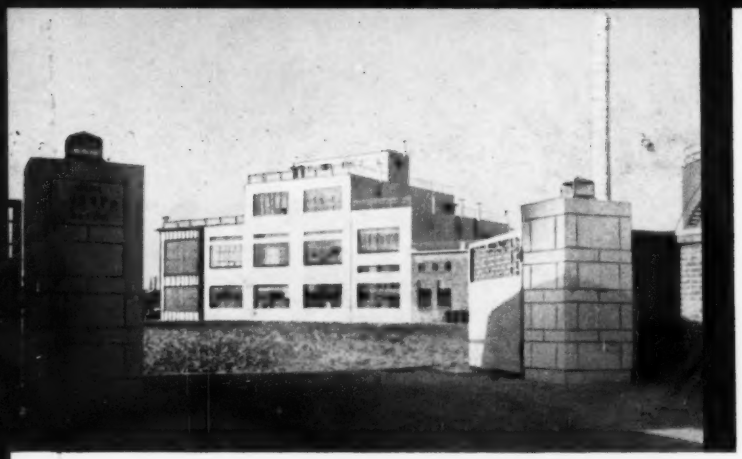
High-quality alcohol for human consumption and industrial use	rectified spirit 96,5 % vol.	active dry baker's yeast (saccharomyces)	In granules 92 % dry substance can be stored without losing its baking power
Used as power fuel for addition to motor car petrol	absolute alcohol 99,8 %	Baker's yeast (saccharomyces)	28 % dry substance
For various industrial uses	glacial acetic acid 99 %	Nutrient yeast (torulopsis)	For human consumption high protein and vitamin content used as substitute for meat
Used as solvent for paint and lacquer industry	ethyl acetate	fodder yeast (torulopsis)	Used as additive to animal fodder with high protein and vitamin content



Further plants for: CO_2 or dry-ice production · Utilization of slop

BMA is well-known for the delivery of complete sugar plants and plants for the utilization of molasses according to modern technology.

Our specialists will give you any detailed information you require for the most profitable utilization of molasses.

For further information write for our leaflet "Profitable Utilization of Molasses"

BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT

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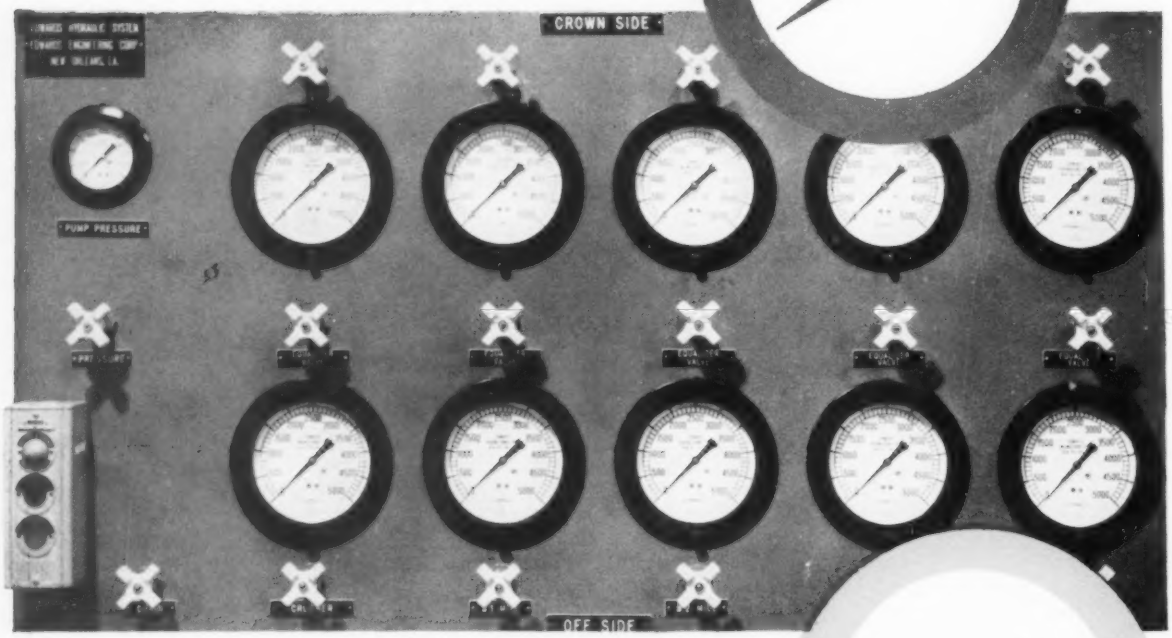
BMA 153

MODERN CENTRALIZED CONTROLS BY "EDWARDS"



Add to the convenience and attractiveness of your Sugar Cane Milling Train with EDWARDS CENTRAL HYDRAULIC CONTROL PANEL which allows one operator in one place to:

1. — *Adjust pressures in all mill top rolls.*
2. — *Adjust and synchronize lift of all mill top rolls.*
3. — *Control the feed through the first grinding unit.*
4. — *See at a glance the pressures in all mill cap rams.*
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8. — *Verify at all times the condition of the hydraulic system.*

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YORKSHIRE IMPERIAL METALS LIMITED

YORKSHIRE IMPERIAL

place at your disposal
their long, specialised experience
in the metallurgical development
and manufacture of

TUBES FOR THE SUGAR INDUSTRY

The resources of Yorkshire Imperial Metals Limited are devoted solely to the manufacture of non-ferrous tubes, plates and fittings, and plastic tubes and fittings. They have long been intimately associated with the Sugar Industry, both at home and overseas, and have made a careful study of the varied and often arduous operating conditions which obtain in the Industry. This study has resulted in the development of improved tube and plate alloys, metallurgically designed and scientifically manufactured to give the best possible service. This unrivalled experience is at your service, free of charge and without obligation, to assist in the solution of problems of all kinds affecting the life and use of non-ferrous tubes and plates.

Yorkshire Imperial craftsmanship, metallurgical skill and specialised experience, together with modern plant and methods and accurate control at every stage of manufacture, account for the enviable reputation which *Yorkshire Imperial* tubes and plates and *Yorkshire Imperial* fittings have achieved in their respective fields.

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P5.42

the experience of years!

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uses their years of experience in making

SUGAR ROLLERS

MANUFACTURED AND RE-CAST
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MOST COMPETITIVE PRICES

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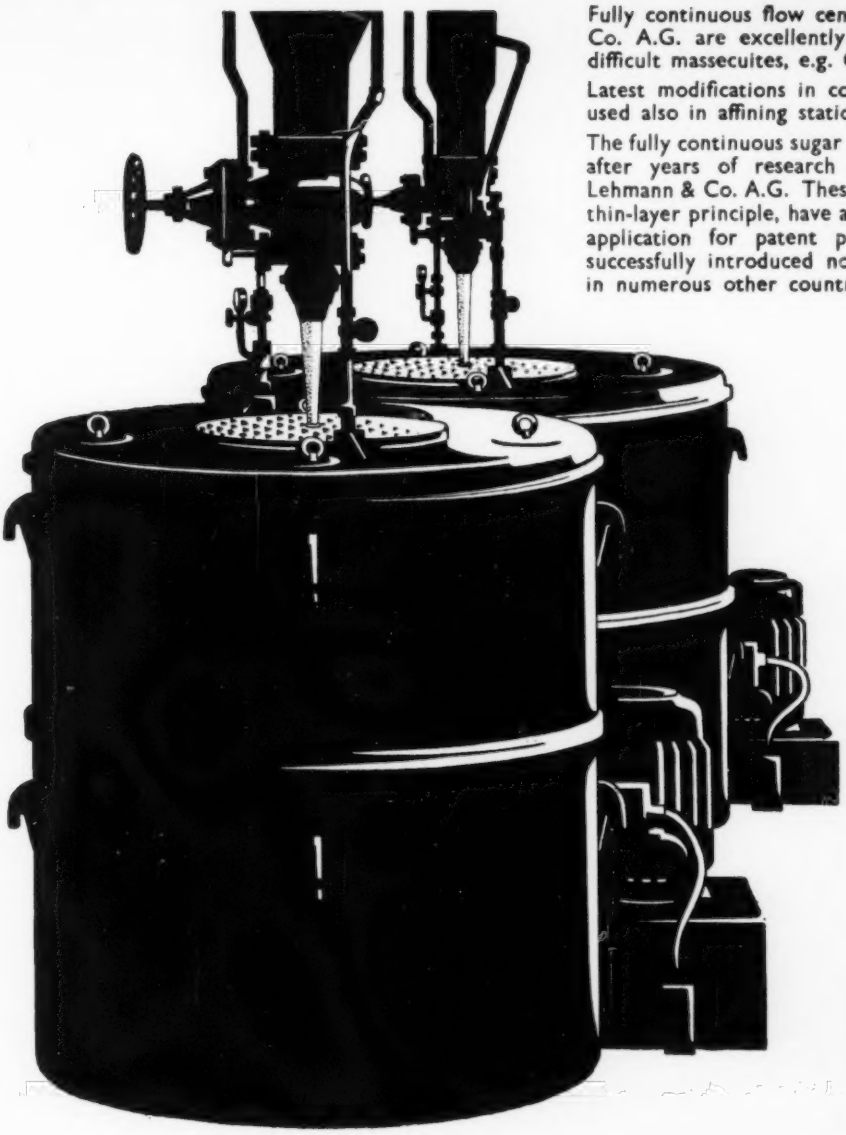
THE COMPLETE ANSWER
TO SUGAR-MILL EFFICIENCY

G. M. HAY & CO. LTD. **Ironfounders, GLASGOW**



Fully continuous flow centrifugals of Hein, Lehmann & Co. A.G. are excellently suitable for curing of most difficult massecuites, e.g. C-, final or second product.

Latest modifications in construction allow them to be used also in affining stations.

The fully continuous sugar centrifugal has been perfected after years of research and development by Hein, Lehmann & Co. A.G. These centrifugals, working on the thin-layer principle, have already been copied in spite of application for patent protection. They have been successfully introduced not only in Germany but also in numerous other countries.

Fully Continuous Flow Centrifugals

offer the following advantages:

- continuous working
- reduction of working personnel
- small current consumption, no current peaks
- high output
- light weight
- no special foundations
- vibration-free running
- uniform sugar quality

HEIN, LEHMANN & CO.

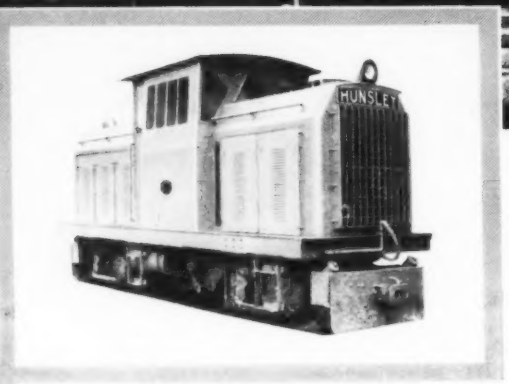
Aktiengesellschaft Duesseldorf

Abt. Massentrennung

Telephone: 70201 *Telex:* 0858 2740 P.O. Box 4109

SERVING THE SUGAR INDUSTRY

A fleet of Hunslet 204 h.p. 0-6-0 type diesel locomotives on heavy sugar cane haulage duties on a sugar estate in the West Indies.



230 *h.p. 'Articulated' diesel locomotive.*

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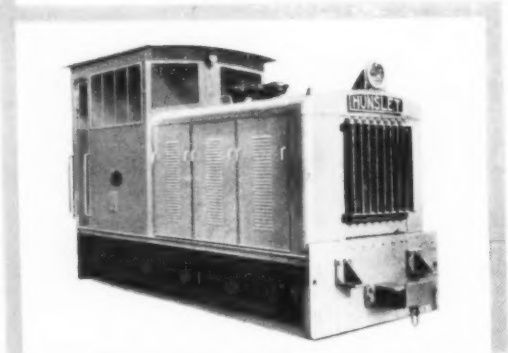

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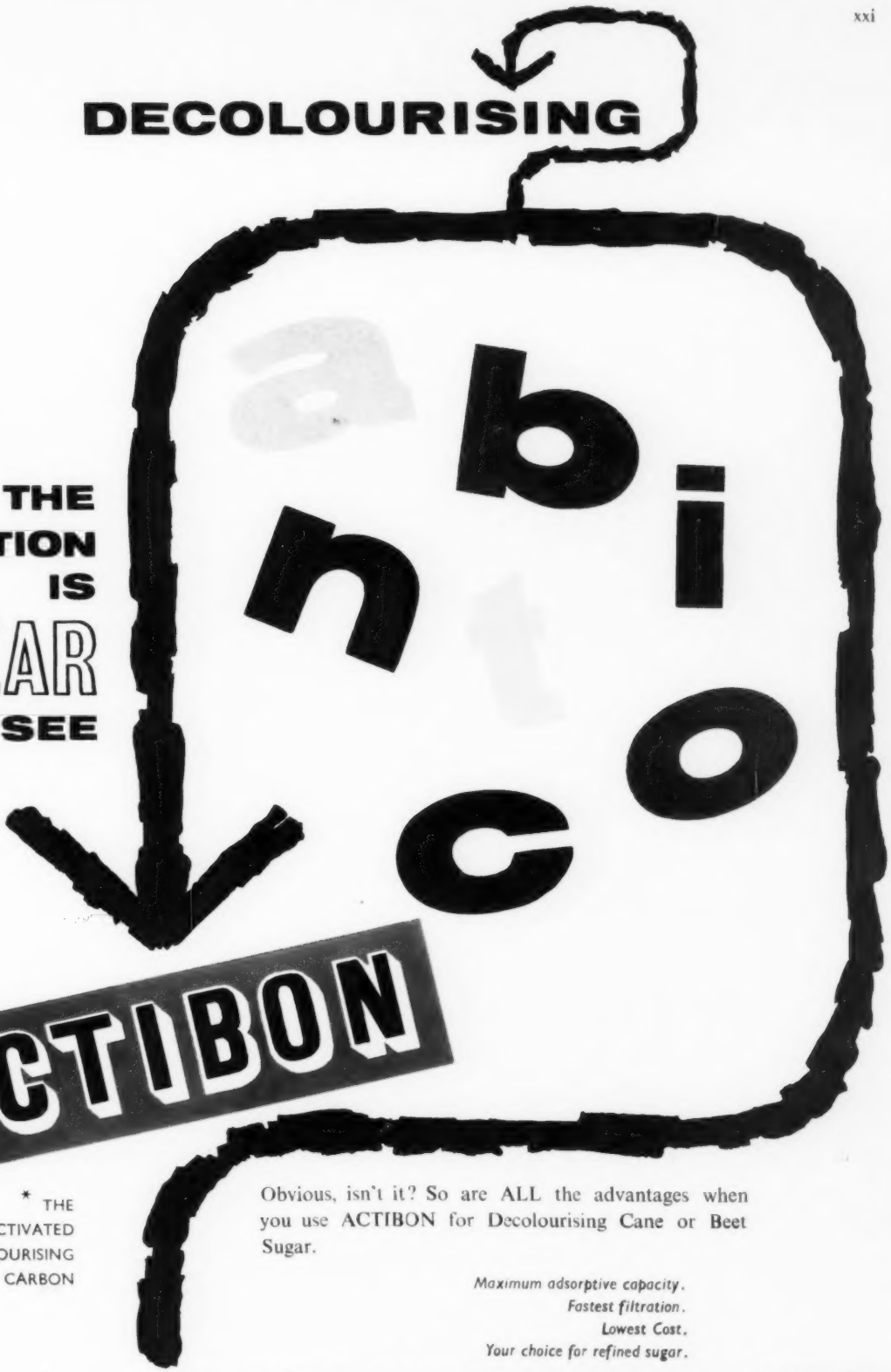

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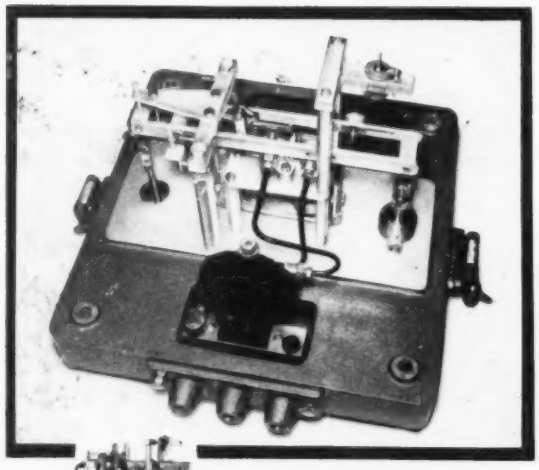

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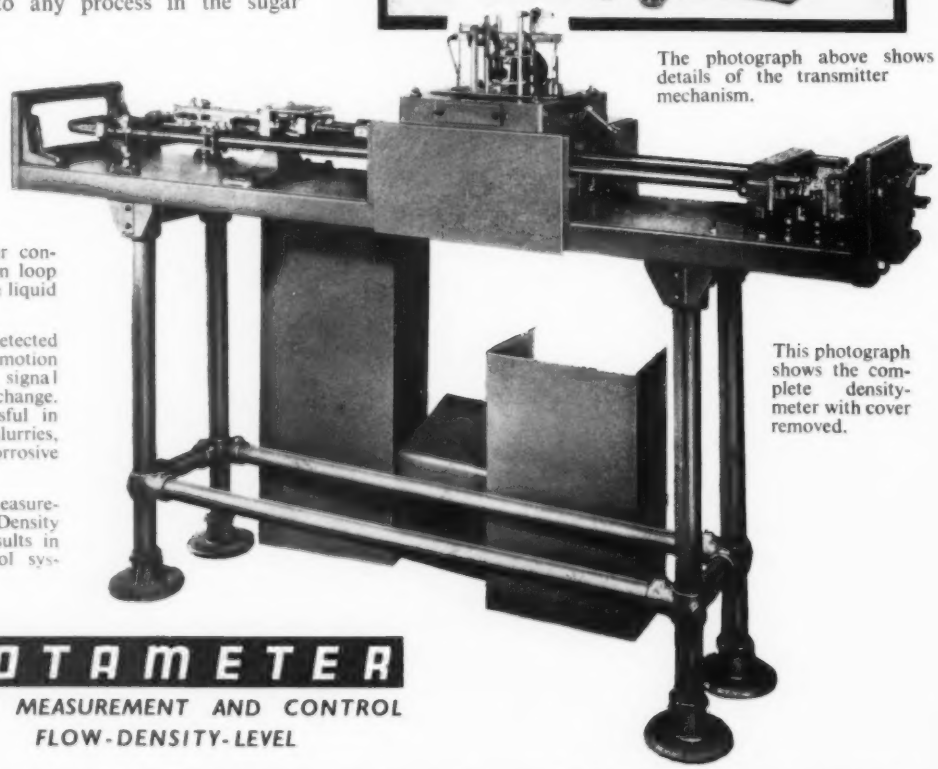

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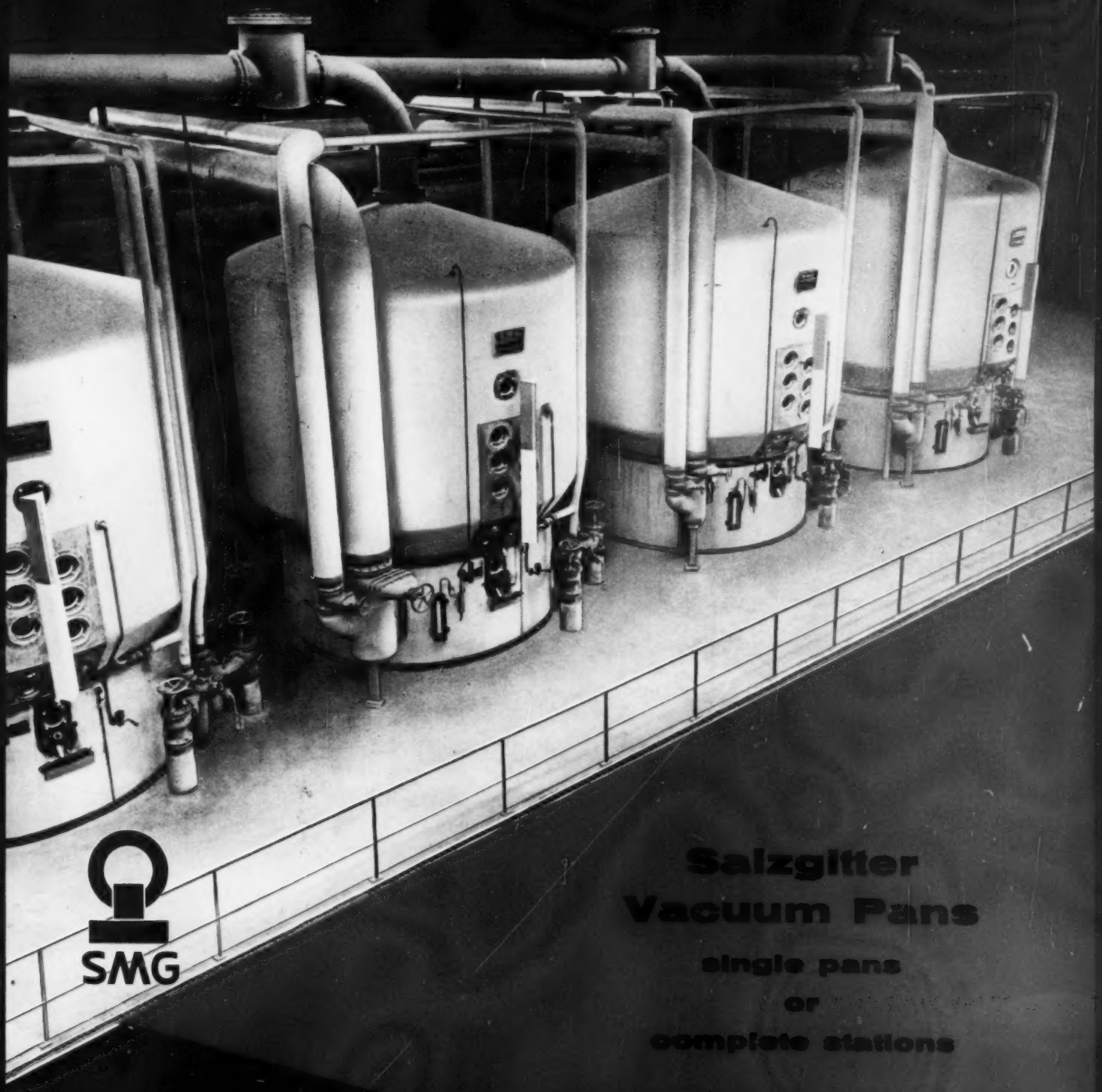

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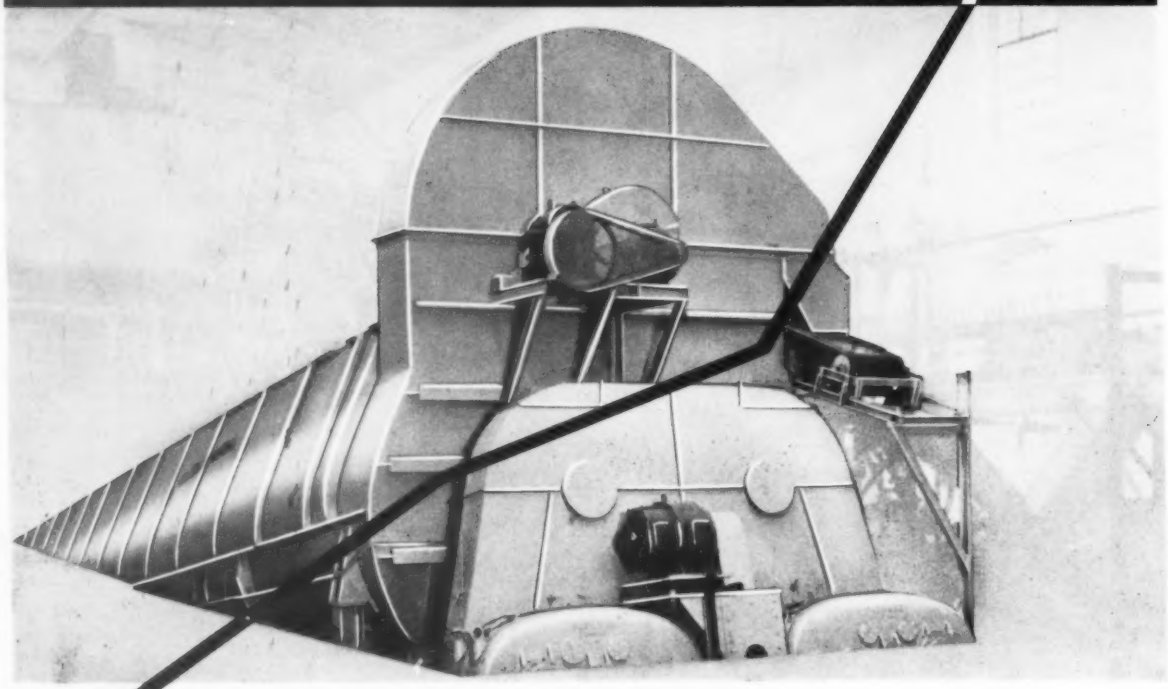

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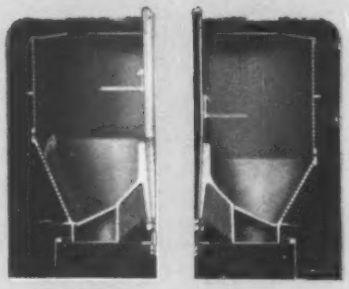

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXIII APRIL, 1961 No. 748

NOTES AND COMMENTS

International Sugar Council.

The Ninth Session of the International Sugar Council was held in London on 22nd and 23rd February 1961. Dr. YUSUF ISMAIL (Indonesia), Vice-Chairman of the Council, presided until Mr. MORI (Japan) was elected Chairman for the rest of 1961 in place of Mr. K. MATSUMURA (Japan) who had been recalled to other duties in his country. The Session was attended by representatives of thirty-six countries and an observer from F.A.O. The Council welcomed three new members, namely Colombia, Ecuador and New Zealand.

The Council considered the situation created by the termination in January of this year of the New York Coffee and Sugar Exchange Contract No. 4—which had served as a basis for the operation of the price provision of the Agreement. The Council agreed that its criterion for the remainder of 1961 should be an arithmetical average of the spot price established under the New York Coffee and Sugar Exchange Contract No. 8 and of the London Daily Price, after conversion of those prices to a U.S. cents per pound avoirdupois, f.a.s. Cuban port basis.

The Council, having reviewed the market situation and all other factors affecting supply and demand, estimated that supplies available to the market in 1961 exceeded requirements by about one million tons.

In the opinion of the Council the supply and demand position (on the assumption that the U.S.A. does not buy Cuban sugar in 1961) was likely to be as follows:

Present Net Import Requirements of the free Market	6·9	million tons
Additional purchases by the U.S.S.R. from Cuba if the U.S.A. buys no Cuban sugar in 1961	1·7	,, ,,
Total imports	8·6	,, ,,
Present Quotas in effect (85% of basic export tonnages) plus other permissible exports under the Agreement and likely exports fron non-participants	6·6	,, ,,
Tolerance above quotas under Article 8	3·0	,, ,,
		approx.
Total available supplies	9·6	,, ,,

In estimating import requirements the Council was informed that the purchases by the U.S.S.R. from Cuba were for internal consumption and that total exports from the U.S.S.R. would not exceed their customary level.

In order to re-establish an equilibrium between supplies and requirements the Council decided that:—

(*a*) in accordance with Articles 21(1)(v) to reduce quotas in effect by 2½% to 82½% of basic export tonnages;

(*b*) to relieve member Governments of the obligation to declare shortfalls during the remainder of 1961, the result of this being that there will be no redistribution of shortfalls for 1961.

The Council estimated that the effect of this action would be to reduce available supplies by about one million tons, thus establishing a real balance between available supplies and requirements.

Present quotas in effect are given below.

Country	*Metric tons raw value*
Belgium	45,375
Brazil	453,750
China (Taiwan)	618,750*
Colombia	4,500
Cuba	1,992,375
Czechoslovakia	226,875
Denmark	61,875
Dominican Republic	540,375
France	18,000
Haiti	40,500
Hungary	36,000
Indonesia	330,000*
Italy	18,000
Mexico	61,875
Netherlands	36,000
Peru	404,250
Philippines	40,500*
Poland	181,500
Portugal	18,000
U.S.S.R.	165,000
Total	5,293,500†

* Including Special Reserve under Article 14(5).

† Article 14 also provides that Costa Rica, Ecuador, El Salvador, Guatemala, Nicaragua and Panama may each export up to 5,000 metric tons raw value each year. Belgium may export 25,000 metric tons to Morocco, and France may export up to 380,000 metric tons to the free market without charge to their quotas.

South Africa and the Commonwealth.

The decision by Dr. VERWOERD to withdraw the South African application for renewal of her membership of the Commonwealth became inevitable when it became clear that his Government's racial policies were condemned and opposed by all the other Commonwealth Prime Ministers. After the 31st May South Africa will be a Republic outside the Commonwealth but this is not to say that she will not enjoy Commonwealth preferences and participate in the Commonwealth Sugar Agreement. In the cases of Ireland and Burma preferences were maintained after they left the Commonwealth, and in view of the enormous fund of goodwill between the peoples of South Africa and the U.K., it seems possible that these precedents will be followed. Government action would be necessary if the Commonwealth Sugar Agreement were to be modified as a result of the South African decision, but no information is as yet available as to whether any changes are contemplated.

* * *

U.S.D.A. report on sugar[1].

The U.S. Department of Agriculture's "Special Study Group on Sugar" has submitted a comprehensive report to the House Agriculture Committee analyzing the present U.S. sugar programme and the outlook for the future. The report stated that, "in a large sense, the goals of our sugar legislation have been realized." The domestic industry has been maintained and "shown vigorous growth in recent years," the export trade has been encouraged, and adequate supplies of sugar have been available at reasonable prices. Domestic and foreign supplies now and in the immediate future will be more than adequate to fill U.S. consumer demands. Both producers have the capacity for considerable expansion.

"The U.S. must decide whether it should reserve a place for the return of Cuba to participation in our sugar market." Formerly its largest supplier, Cuba now is banned from the U.S. market. Should Congress decide to change the present Sugar Act a new sugar programme could be built around three basic devices: quotas, tariffs, or direct payments to producers or combinations of the three devices. An abrupt move to a fourth alternative—a completely free trade in sugar—would be "disruptive."

The report was prepared at the request of the House Agriculture Committee by a special U.S.D.A. study group directed by Nathan M. Koffsky, Deputy Administrator of the Agricultural Marketing Service.

Much of the report was a projection to 1970 of current production and consumption trends illustrating what might be expected in the way of production, requirements and supply in various situations. These points were made:

1. *Consumption.*—Growth in population "will continue to be the most important factor in determining sugar requirements in the U.S." Per capita consumption has levelled off at about 97 lb per person.

Consumption in 1960 was about 9·3 million tons. By 1965 it will be 10·3 million tons and by 1970 it will be 11·3 million tons.

2. *Acreage.*—"Two important developments of the 1950's have changed the competitive position of sugar crops relative to other crops" and helped stimulate production. One is the "rapid reduction in labour requirements for producing sugar" and the other has been "the relatively more favourable price received for sugar than for other crops." The latter has been due principally to a 15% decline in other farm prices.

In the period of 1948-50 to 1957-59 there has been a 20% reduction in man-hour requirements for production of beet sugar. Domestic sugarcane producing areas showed reductions for the same period ranging from 56% in Florida to 22% in Puerto Rico.

3. *Projected production.*—The study projected beet and cane production in the U.S. and off-shore areas by 1970 under three price consideration. Data for the projections were collected from research economists in 32 states and Puerto Rico, colleges, experiment stations, sugar companies and other sources.

Even under 1959 prices the domestic beet and cane industries have the potential of producing all but 3 million tons of U.S. requirements by 1970, and under an increase in prices they could produce more than the U.S. could consume.

The beet sugar share of the U.S. production under rising prices would increase from the present 46% to about 62%, indicating the far greater potential expansion for sugar beets than sugar cane, the latter being restricted by climate to smaller and fewer growing areas.

4. *Foreign supplies.*—At the present time the U.S. is the world's largest importer of sugar. The level and stability of prices here make it very favourable market. World production of sugar is increasing faster than consumption. Current world production is about 51·5 million tons; by 1970 it will be about 75 million tons.

Until recently Cuba supplied the U.S. with about 3 million tons a year but "now that recent events have disrupted the relationship formerly existing between the United States and Cuba, it is questionable whether Cuba will again become the major source of foreign sugar for this country."

Therefore, the U.S. may have to seek other foreign sugar supplies. Under 1959 prices, foreign countries could supply the U.S. with 8·8 million tons by 1971, the remaining 2·5 million tons being supplied by domestic producers; with a 25% increase in prices over the 1959 level foreign supplies could amount to about 11 million tons or nearly all of U.S. consumption for 1970.

[1] U.S. Beet Sugar Industry Newsletter, 1961, **2**, (2), 1, 4.

THE SUGAR CANE IN HAWAII

Papers from the 18th Annual Meeting of the Hawaiian Sugar Technologists, 1959, are discussed below.

Economics

WITH the rising costs of labour and equipment in a competitive world market, effort becomes concentrated on reduction of costs. But there is one powerful reservation: the openings for such reduction are limited to such methods as will not result in a collateral reduction in output of the ultimate commercial product. This theme runs through the numerous papers and forms the central thesis of the Meeting and is, perhaps, most succinctly illustrated by the diagrams attached to a paper by D. J. MARTIN, "Effect of Yield Losses", showing a strong negative correlation between yield, measured as tons sugar produced per month, and cost of recovered sugar per ton.

Costs fall into two heads: capital and operating. At Waialua capital expenditure is determined not by need but by availability of funds. There has now been introduced a system under which all proposals for capital investment are submitted to analysis by an "investors' method" in which account is taken, among other factors, of the rate of return, payout period and whether capital is required for proven or experimental use. The anonymous note is accompanied by a useful index of literature on the administration of capital spending.

W. GIBSON, in his paper, "Target Areas for Cost Reduction", emphasizes the narrowness of the field for operational cost reduction and discusses this field under the headings of field and factory, administration, equipment and rental, depreciation and marketing and shipping. Costs under these headings are then further broken down and charted. Harvesting hauling at $14 m forms the heaviest item and is set against field losses at $13 m. Irrigation is the second largest cost, but here the border-line is confused, for in this are included the costs of certain supplementary field operations, limited to irrigated areas, such as repairing and maintaining irrigation facilities. Fertilizers form the third largest item with a growing cost for weed control. Suggestions are made for a further break-down of costs together with "work sampling" and watching the other man and seeing if you can beat him to it.

From a somewhat different standpoint, A. KELLER writes on potential improvements in cane and sugar production. He deals with the need for reducing the losses arising from disease, unclean mechanically harvested cane and delayed milling. Among his further improvements are superior varieties tailored to the needs of mechanization and improved machinery to minimise the amount of trash, tops and dirt delivered at the factory. In a further paper he deals with the problem of losses in processing.

Again, adopting a different standpoint, H. F. CLEMENTS discusses the field aspects of quality in sugar production. These include the physiological sequences which culminate in a minimum tons cane/tons sugar ratio, deterioration due to burning, damage in mechanical handling and delayed milling. R. L. HUBBARD in his "Approach to Reducing Maintenance Costs", presents a five-stage programme. Two further papers by W. KENDA and P. VAN ZWALENBURG, bear less directly on the agricultural aspects of cost reduction.

From yet another standpoint, R. A. HAGSTROM reviews the "Economics of Increased Age of Cane", with a series of striking diagrams which clearly demonstrate the economic importance of age. The agricultural aspects on which, ultimately, the best age for cutting depends, including varietal and environmental characteristics, form the subject of a paper, by W. P. NAQUIN Jr., closely linked to the preceding paper.

Cultural Operations

In his paper, "Space Planting of Sugar Cane", R. L. WOLD notes that, under normal cultural conditions, stooling ability is in excess of the available sunlight with, consequently, a high % of stalk mortality, and of young immature shoots. Ninety-two replicated tests, comparing normal 5 ft-row planting with one in which every third line is left blank, show no significant gain or loss of sugar. But, here again, economic considerations enter; the 2-plant one skip row system shows a saving of $27·47 per acre for plant cane and $6·28 for ratoons.

The question of replanting in ratoon crops, again, has an economic bearing, for the cost at Grove Farm is placed at $23·00 per acre. Preliminary trials covering replanting all, or varying percentages of, gaps of 3 ft or over are described by W. J. CRITTENDEN. The records at harvest show that a considerable proportion of the replants died and that, per each replant, on average a single stalk of small size was produced and that no perceptible increase of yield resulted.

In matters concerning irrigation, the factors affecting furrow grade are considered by E. M. NORUM who points out that variability in furrow grade is as important as the mean slope. This has a bearing on the question of the desirability of land-smoothing operations. The study involves the mathematical determination of what are termed "tolerance limits".

Pursuing the same subject into the practical field, J. M. LANGA describes the effect of land forming on furrow irrigation at H.C. × S. & Co. The measure of efficiency here is acres irrigated per man-day, but the comparison is between plant (smoothed) and ratoon crop (normal) while yield figures are, as yet, not available.

Harvesting is covered by a single anonymous note describing a new harvesting method under development by the Waialua Agricultural Company and, again, the system is consequential on the breaking down of normal costs. The new system is described in some detail and, on the financial side, it shows a reduction of harvesting costs from $751 per 1000 T.G.C. to $563; in other words, on a capital expenditure of $153,000 a first year saving of $75,000. As yet imponderable gains include greater safety to the labour force and less ground compaction.

Two further papers with a more theoretical approach to questions of irrigation are included in the Proceedings. D. C. Cox *et al.* outline a series of evapotranspiration experiments connected with the control of irrigation, and R. B. Campbell describes an infiltration equation and its use as a guide in furrow irrigation.

Herbicides

A single paper by M. Isobe *et al.* describes a preliminary attempt to assay the residual effects of CMU and DCMU as indicated by growth of Sudan Grass.

* * *

Further information on Hawaiian practice is given in two issues of the Hawaiian Planters' Record. The earlier issue[1] contains a number of articles covering a wide range of subjects and a brief summary of these follows.

A survey of plantation fertilizer practices, indicating the changes during the period 1949/1959, is presented by R. P. Humbert. The changes are considerable and the three major factors are the use of liquid N fertilizers, supplemental applications to unirrigated land by aeroplane and the cultivation of more vigorous varieties. These higher fertilizer applications are held to be responsibe for a two ton per acre increase in sugar production. The same author describes in greater detail the use of aircraft for supplementary application and foliar absorption is discussed. Another use of aircraft, described by R. E. Doty, is for spreading baits for rats; it includes a comparison both of the form of bait, pellets or torpedos, and the various poisons used.

With the introduction of mechanical harvesting, a large increased accumulation of waste organic matter, mainly tops and trash, takes place at the mill. The use of this for the improvement of heavy soils and those tending to puddle either naturally or during harvesting is considered by G. Y. Ewart and R. P. Humbert. On heavy clays it is stated that up to 3 tons more sugar may be expected through the incorporation of 15–30 tons trash or bagasse per acre and that the duration of the improvement ranges from a minimum of six to eight years and that it has been observed to last up to 18 years. Cost of application of 15–30 tons range from $30–$40 per ton. In the drier areas an 18–24 months' stock piling of trash or bagasse is recommended, but for six months in the wetter. Whether steps are taken to maintain aerobic conditions in the stockpile is not noted.

In irrigated districts control in the use of water is of great economic importance. In the last 20 years methods of exercising such control have been investigated, inclusive of Bouyoucos blocks and tensiometers or, in their latest form, irrometers. The construction, standardization and use of these instruments are described by A. H. Cornelison and R. P. Humbert. Passing to the other extreme, R. P. Humbert and J. H. Payne deal with the losses resulting from harvesting in wet weather. An increased milling capacity, enabling closing down to be effected in wet weather, is considered worthy of consideration.

Two articles remain to be mentioned. G. O. Burr describes a system of weighing bagasse by use of the gamma radiation absorption principle[2] and suggests that the same principle might be used for weighing raw sugar. The necessary equipment and the procedure are described and illustrated. In the second article T. A. Jones and R. P. Humbert apply a spectrographic method to the study of the nutrient content of sugar cane. Analytical methods for the determination of the tissue content of the major nutrients have been evolved and now form a routine operation in several countries to supply guidance in fertilizer pratice. The method here described is designed to provide similar information about the essential "trace" elements.

The later issue[3] constitutes a valuable record by L. D. Baver on plant and soil composition relationships as applied to cane fertilization. The work presents the HSPA experience and conclusions arrived at in these wide matters and might almost deserve the term monumental. Its 150 pages are divided into nine sections and four appendices, and the central feature of each section is a series of charts to which is attached a brief explanatory statement. The chemical composition of the plant tissues form the first section with its relationship to age (section B). Subsequent sections deal with the inter-relationships of the composition factors (C), composition in relation to fertilization (D), yield in relation to fertilization (E) and composition (F), and yield response in relation to composition (G). These sections lead up to the two summations, composition as an index of fertilization (H) and cost analysis of the different analytical methods.

H. M.-L.

Weeds—what must we do about them ? J. Gordon. *S. African Sugar J.*, 1960, **44**, 951, 953.—The problem of weeds is discussed in its economic aspect, primarily concerning the use of mechanical control. The herbicides so far tested have adversely affected cane growth.

[1] 1960, **55**, (4).
[2] *See also I.S.J.*, 1961, **63**, 19.
[3] 1960, **56**, (1).

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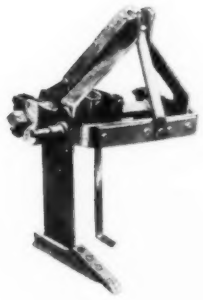

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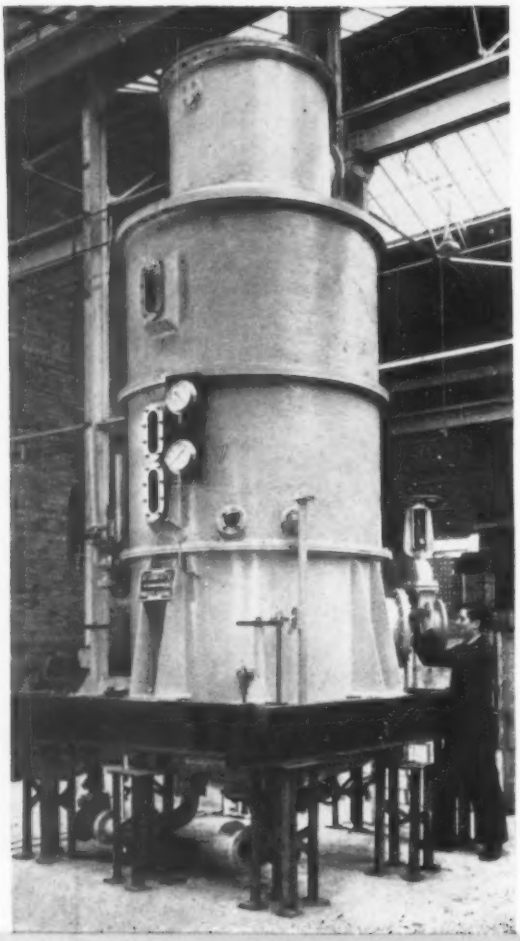

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AN INTERESTING SUGAR PAINTING

By F. N. HOWES (Royal Botanic Gardens, Kew, Surrey)

IN the Museum at Kew Gardens there is on view a striking and life-like oil painting of a group of Africans working a primitive sugar mill in East Africa. The photographic reproduction here shown may give some idea of the painting, and the primitive wooden mill employed, although it is a very inadequate representation of the actual picture. It was painted by Thomas Baines about a century ago, Baines' South African paintings having attracted much attention in South Africa and in Britain at that time.

As the labelling with the painting indicates, the scene was one at Katipo, fifteen miles from T[illegible] (on the Zambesi in Portuguese East Af[illegible]) and represents the cutting of the cane into lengths, crushing it in the mill, and the boiling of the juice to produce crude

sugar or jaggery. This early type of sugar mill, with its wooden rollers, was in common use in India and other cane growing countries at one time. It was later largely superceded by a similar simple mill with metal rollers and cogs which was much less cumbersome. The wooden mill consisted essentially of two vertical wooden rollers, carved from hard logs, the one connected with a capstan and both furnished with matching intermeshing grooves or teeth, between which the pieces of cane are fed, one at a time, when the mill is in operation. By modern standards the scene here shown suggests a great extravagance of man-power, but in those far off days, who knows, this form of cane milling may have been looked upon as a diversion or one way of spending the time!

At what time or what date the milling of sugar cane and the preparation of jaggery first came to be practiced in East Africa by Africans seems to be lost in the mists of time. It is known that Arab traders, in their dhows, visited East African ports for the purposes of barter and trade (as they still do today) from very early times. They may well have introduced this primitive method of cane milling and the preparation of jaggery, being familiar with it in other countries. It was the Arabs who brought sugar cane growing to Egypt, which they conquered in A.D. 641. They also took it to other Mediterranean countries. The Moorish sugar industry of Spain was well established by A.D. 1150.

Thomas Baines, the painter of the picture, was himself an interesting character. Born at King's Lynn in 1822 and the son of a master mariner he showed early interest or talent in painting and natural history. His father placed him with a coach builder to learn the art of heraldic painting on carriage panels. At the age of 21 he migrated to South Africa and built up a reputation for himself at the Cape with his painting and writing. He travelled extensively into the hinterland and accompanied several expeditions. He painted the African landscape, war scenes (the "kaffir wars"), native and animal life etc. It is said of him at the Cape that there were few men who were thought so much of, or talked so much of, for so many years, as the artist-traveller Baines. He died of dysentery in Durban in 1875. Baines Kloof in Natal may perpetuate his name.

AGRICULTURAL ABSTRACTS

Field testing programme. G. S. BARTLETT. *S. African Sugar J.*, 1960, **44**, 667–669, 671.—Brief notes are given on the latest machines now under trial.

* * *

Yield of sugar cane in India. V. SAGAR. *Indian Sugar*, 1960, **10**, 333–340.—This account of the Provincial sugar yields contains a tabular statement of the yield trends over the past 10 years. Andhra Pradesh showed the highest yield per acre in 1958/59, 37·5 tons (1949 59 mean 29·2), with Bombay second 25·5 tons (mean 25·9) and all-India 14·7 tons (mean 13·3). At the other extreme lies the U.P. with 11·2 tons (mean 11·1). The latter is of particular interest for, some 30–40 years ago, treble this yield was regularly obtained on the Departmental Sugar Cane farm at Shahjahanpur. The secret of that success lay in the regular use of organic matter; but the lesson seems to have been lost for, under the discussion of manures and fertilizers as among the causes of these variations, organic matter is not even mentioned.

* * *

Will there be sufficient harvest labour ? ANON. *Producers' Review* (Queensland), 1960, **50**, (7), 19, 21. The supply of seasonal labour in a period of high employment always offers difficulty. The way this difficulty has been overcome in the Queensland sugar industry is described here. The organization concerned is the Commonwealth Employment Service, working in close association with the Queensland Cane Growers' Council.

Cane transport scenes. ANON. *Australian Sugar J.*, 1960, **52**, 299–303.—Brief details, explanatory of the illustrations of recent developments, are given.

* * *

Mechanical aids in Queensland cane farming practices. ANON. *Australian Sugar J.*, 1960, **52**, 617–623. The article follows the same illustrated lines as in the preceding abstract but describes the various machines for topping and loading.

* * *

Some problems connected with sugar cane ratoon cultivation. R. R. PATRI. *Indian Sugar*, 1960, **10**, 403–405.—Among the points considered is that of filling gaps both directly by setts or with plants raised in nurseries. The risks attendant on growing a second ratoon crop of the harbouring of pests and diseases is emphasized.

* * *

Sugar cane problems in the Philippines. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1960, **7**, (8).—The Bulletin draws attention to the too great reliance on a single variety, POJ 3016, now occupying 54% of the total area and rapidly extending. So far Co 440 and Co 449 have proved most satisfactory and are recommended. Tabular statements are given of the variety trial results.

* * *

A guide to the use of fertilizers. J. WILSON. *S. African Sugar J.*, 1960, **44**, 741, 743.—The article draws the conclusion from the latest evidence that, in many cases, fertilizers have been used in excess quantity and thereby the return per unit of fertilizer has been reduced. Broad recommendations are given for the various types of soil which will lead to maximum economy. Instructions for soil sampling are given, but no mention made of that very important point, the seasonal time of sampling. There is growing evidence of the wide variations which may occur in the amounts of available nutrients at different seasons.

* * *

Some observations on the effects of frost on sugar cane. J. WILSON. *S. African Sugar J.*, 1960, **44**, 837, 839. In certain areas of Natal frosts occur in varying degrees. The effects are discussed, particularly with reference to the practice of burning.

* * *

Weeds of Mauritius. E. ROCHECOUSTE, R. E. VAUGHAN and L. S. RELAND. *Mauritius Sugar Ind. Res. Inst. Leaflets*, 1959, (1, 2, 3), 4 + 4 + 7 pp.—Weeds of cane fields in Mauritius are described and illustrated, viz.1. *Bidens pilosa*, 2. *Cassia occidentalis* and 3. *Oxalis latifolia*, *O. debilis* and *O. repens*. Their ecology and distribution are briefly discussed, diseases and insect pests mentioned and control measures outlined. *Bidens pilosa*, a weed of the New World now widely distributed throughout the subtropics is said to have been controlled in cane fields by pre-emergence applications of "Monuron" or "Diuron" at 1·6–3·2 lb per acre. This treatment is also said to be effective with *Oxalis* although ploughing, followed by MCPA or 2,4-D (preferably esters) at 3–4 lb per acre, is recommended.

* * *

The West Indian sugar industry. P. RUNGE. *J. Roy. Soc. Arts*, 1961, **109**, 91–104.—The author is Vice-Chairman of Tate & Lyle Ltd. and read this paper at the Commonwealth Section of the Society on 24th November 1960. World consumption of sugar is now about 45 million tons. Average consumption in the United Kingdom is 112 lb a year: 400 years ago its consumption could be compared with caviar! In comparison Australia consumes 118 lb, the United States 96 lb, France 66 lb and at the other end of the scale Nigeria 4 lb and China 3 lb. The paper was presented under the following headings—what is sugar: what are the West Indies: economic background: agricultural operations: factory operations: sugar markets: refining.

* * *

Eradication of nut grass. M. B. TIPPANNAVAR, S. V. HIREGOUDAR and H. R. ARAKERI. *Mysore Agric. J.*, 1959, **34**, i22–i26.—About 90% control of this troublesome weed or sedge (*Cyperus rotundus*) was obtained in sugar cane land by tillage followed by two sprays of 1·5 lb 2·4-D in 60 gal.

* * *

Mechanized land preparation vs. animal land preparation in the production of sugar cane. S. R. CRUZ *et al. Araneta J. Agric.*, 1959, **6**, 145–159; through *Hort. Abstr.*, 1960, 6214.—A statistical examination was made of the returns of all cane farms, in factory groups, in the Philippines for the period 1947–1955. The increases in the average yield attributable to mechanized cultivation was highly significant and ranged from 9·87 to 47·6 tons per ha per annum.

* * *

Ratoon stunting disease of sugar cane and the means of control. E. V. ABBOTT. *Suelo tico*, 1959, **11**, 23–29; through *Hort. Abstr.*, 1960, 6214.—The relative merits of hot air and hot water treatment are discussed. The technique of the latter is described, and recommendations are made for disinfecting harvesting knives.

METHODS FOR THE ASSESSMENT OF BEET QUALITY

By A. CARRUTHERS and J. F. T. OLDFIELD
(British Sugar Corporation Ltd., Research Laboratories, Bramcote, Nottingham, England)

(*Paper presented to the 11th Meeting, Commission Internationale Technique de Sucrerie, September, 1960*)

Part II—Determination of Particular Non-Sugars in Beet

Traditionally, beet quality has been assessed by measurement of pressed juice purity, conductivity and Stanek-Pavlas nitrogen. No satisfactory method is known for compounding the three measurements and none of the measures is specific or capable of precise interpretation.

It is considered that reliable determinations of individual non-sugars provide more useful criteria for the assessment of beet quality. In the course of studies into the relationship between beet composition and factory performance[1,3] specific methods have been evolved for the determination of all the major components of juice and the methods are applicable to aqueous extracts of beet or brei, pressed juice, raw and clarified juices and process syrups.

The analytical procedures for determination of some of the major components are summarized below and a method is suggested for compounding the measures of the principal groups of constituents to give a simple measure of beet quality.

Cations

The principal cations in raw juice are potassium, sodium, magnesium and calcium. Significant quantities of ammonia are not normally present in fresh beet. In British raw juices the potassium: sodium ratio varies from more than 25:1 to less than 8:1. There is generally more magnesium than sodium in raw juice and the potassium:magnesium ratio varies from about 10:1 to 7:1. The calcium content is less than the magnesium content and the potassium: calcium ratio varies between about 25:1 and 50:1. More than 95% of the magnesium and calcium is removed during clarification but the potassium and sodium pass quantitatively into the clarified juice.

An estimate of the total cations may be obtained by conductivity measurements but no great accuracy can be expected in the estimate because of the varying ratios of the principal cations, which have differing specific conductances, and because of the uncertainties arising from the contributions of other ionic species.

It is considered better to estimate potassium and sodium individually by flame photometer. Accurate temperature control and standardization of sugar content, which are essential for conductivity measurements, are unnecessary in flame photometry when using dilute solutions. With adequate light filtration and a sensitive instrument giving full scale deflection at 10 p.p.m. potassium and 5 p.p.m. sodium, it is possible to determine these ions without interference in aqueous extracts of beet or brei prepared as described in Part I, in pressed juice and in raw or process juices. Potassium is more easily extracted from beet by solutions of electrolytes than by water and the values obtained by analysis of the lead extract used for determination of polarization of beet are about 10% higher than the values for aqueous extracts or raw juice.

Magnesium can be determined by flame photometer if an instrument with a very high flame temperature is available. Magnesium and calcium are more readily estimated by volumetric titration with N/50 EDTA. Calcium is determined with ammonium purpurate indicator, while calcium plus magnesium is determined using Eriochrome Black T. For visual detection of the end point it is necessary to ash raw juice or beet extracts before titration because the colour of the solution masks the end point. By use of a photelectric titrator, such as the EEL Titrator Unit, it is possible to determine the correct end point with raw juice or beet extracts because the unit is so sensitive that these juices can be diluted considerably. The juice and indicator is contained in an optical cell and is stirred magnetically during the addition of the titrant while the optical density is continuously recorded on a galvanometer. By use of suitable filters, the correct end point is obtained when the change in optical density for unit addition of titrant is a maximum. Two ml of centrifuged raw juice or 20 ml of second carbonatation juice is diluted to 40 ml for the calcium determination but only 0·5 ml of raw juice is required for the estimation of calcium plus magnesium.

Of the cations present in beet, only about 80% of the potassium and sodium, 50% of the magnesium and 10% of the calcium are extracted in factory diffusion. These ions should not therefore be determined by direct ashing of beet or cossettes if an estimate of juice composition is required.

Betaine

Betaine is quantitatively the most prominent single organic non-sugar in beet juice and therefore it has a considerable influence on purity.

Betaine may be determined in the absence of interfering ions by precipitation with potassium triiodide[4], phosphotungstic acid[5] or ammonium reineckate[6]. All of these methods are suspect in the presence of other ions which can be precipitated by the reagents and the procedures which have been suggested for the removal of interfering ions are tedious[7].

A new method for the removal of all known interfering ions has been developed and found reliable for all process liquors and beet extracts[8]. The method involves pretreatment of the test solution with a mixture of a strong anion exchanger and a weak cation exchanger, for example, "Deacidite FF" plus "IRC 50".

It has been found that the resin mixture does not absorb betaine but quantitatively removes all other ionic species known to be present in beet juices. Since the betaine is not absorbed, the process is not subject to the disadvantages of other ion exchange methods which require elution of the material before estimation. For second carbonatation juice, molasses and all process juices, except raw juice, the betaine nitrogen as determined in the new method is equal to the total nitrogen in the ion exchange eluate and, consequently, the betaine may be determined by any quantitative technique; precipitation as betaine reineckate is recommended.

The eluates from raw juice or beet macerates contain small amounts of nitrogen in excess of the betaine nitrogen; this is probably due to traces of protein passing through the resin. The excess nitrogen in the eluate has been shown not to cause interference with the reineckate-silver nitrate titration or with the colorimetric determination of the betaine reineckate.

There is close agreement between results obtained by the colorimetric and titration procedures, but the colorimetric method is less subject to errors due to insufficient washing of the reineckate precipitate.

After the ion exchange pretreatment[8], a 10 ml aliquot containing 2–15 mg betaine is acidified with 1·0 ml of N hydrochloric acid and 10 ml of saturated ammonium reineckate at pH 1 is added. The mixture is cooled to 5°C and the precipitated betaine reineckate is separated on a sintered glass crucible (porosity No.3) and washed until no further colour is removed, using three 5 ml portions of diethyl ether. The base of the sintered crucible is dried and the precipitate is dissolved quantitatively in 70% aqueous acetone to give a total volume of 20 ml of solution.

The absorption is measured at 525 mμ against 70% acetone. A "Unicam SP 600" spectrophotometer is suitable, using a 1 cm cell. The betaine concentration is determined from an absorption curve prepared by precipitating known amounts of betaine hydrochloride (equivalent to 2–15 mg betaine) under the above conditions. The standard curve is reproducible and it is unnecessary to prepare fresh standards for each series of determinations.

Amino-acids

About half of the nitrogen in clarified juice originates as amino acids in beet. Most of this nitrogen is present in the beet as glutamine which contains both an amide nitrogen and an amino nitrogen group.

The Moore and Stein ion exchange separation of amino acids[9,10] and the ninhydrin colorimetric determination of the individual acids[11] is accepted as the standard research method for estimation of amino-acids. It is too time-consuming for routine analysis in the beet sugar industry where the important measure is not the concentration of the individuals but rather the total concentration of amino acids. This total, in conjunction with the amide content as a measure of glutamine, provides the practical data required for assessment of juice quality and performance.

In the past, the Stanek-Pavlas copper acetate reagent has been used extensively to estimate amino acid nitrogen in beet and it has also been applied to process juices. The value obtained has given rise to the terms "noxious nitrogen," "blue number," etc.

In the absence of any other data it may be that the "noxious nitrogen" or "blue number" provides an estimate of beet quality, in that beet giving a high value are likely to contain more amino acid nitrogen than those giving a low value.

An extensive comparison of "noxious nitrogen" values and individual amino acids in beet has convinced the authors that the "noxious nitrogen" value obtained does not represent the sum of the amino nitrogen of the individual amino acids. In general, the "noxious nitrogen" value exceeds the amino acid nitrogen content. In the beet macerates which have been examined the amino acid nitrogen varied between 60% and 80% of the "blue number". A similar discrepancy was found in raw juice and for second carbonatation juices amino acids represented only 35–60%. For some factory samples the "blue number" for the second carbonatation juice has been found to be greater than that for the corresponding raw juice although the amino acid nitrogen was known to be lower by more than 30% in the second carbonatation juice because of the deamidation of glutamine to form pyrrolidone carboxylic acid.

In order to obtain a more precise estimate, a direct determination of the amino nitrogen in the amino acids has been developed from the colorimetric ninhydrin method of Moore and Stein[11]. The method is applicable to molasses, process juices, raw juice and beet extracts including the half normal lead extract as used for sucrose in beet. The sample is

[3] CARRUTHERS *et al.*: *I.S.J.*, 1960, **62**, 322.
[4] BLOOD and CRANFIELD: *Analyst*, 1936, **61**, 829.
[5] DAVIES and DOWDEN: *J. Soc. Chem. Ind.*, 1936, **55**, 175T.
[6] WALKER and ERLANDSEN: *Anal. Chem.*, 1951, **23**, 1309.
[7] CROMWELL and RENNIE: *Biochem. J.*, 1953, **55**, 189.
[8] CARRUTHERS *et al.*: *Analyst*, 1960, **85**, 272; *I.S.J.*, 1961, **63**, 26.
[9] *J. Biol. Chem.*, 1948, **176**, 367.
[10] *ibid.*, 1954, **211**, 893.
[11] *ibid.*, 907.

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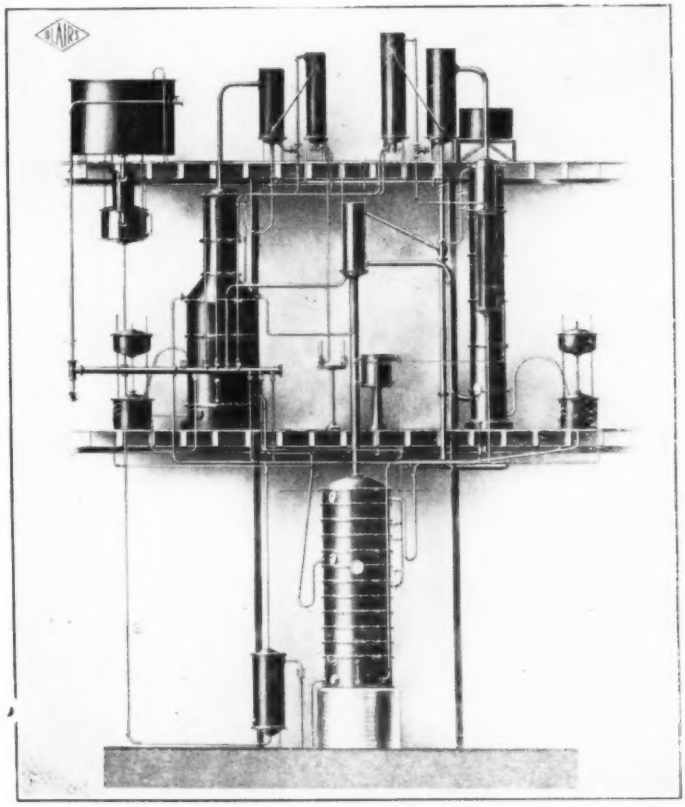

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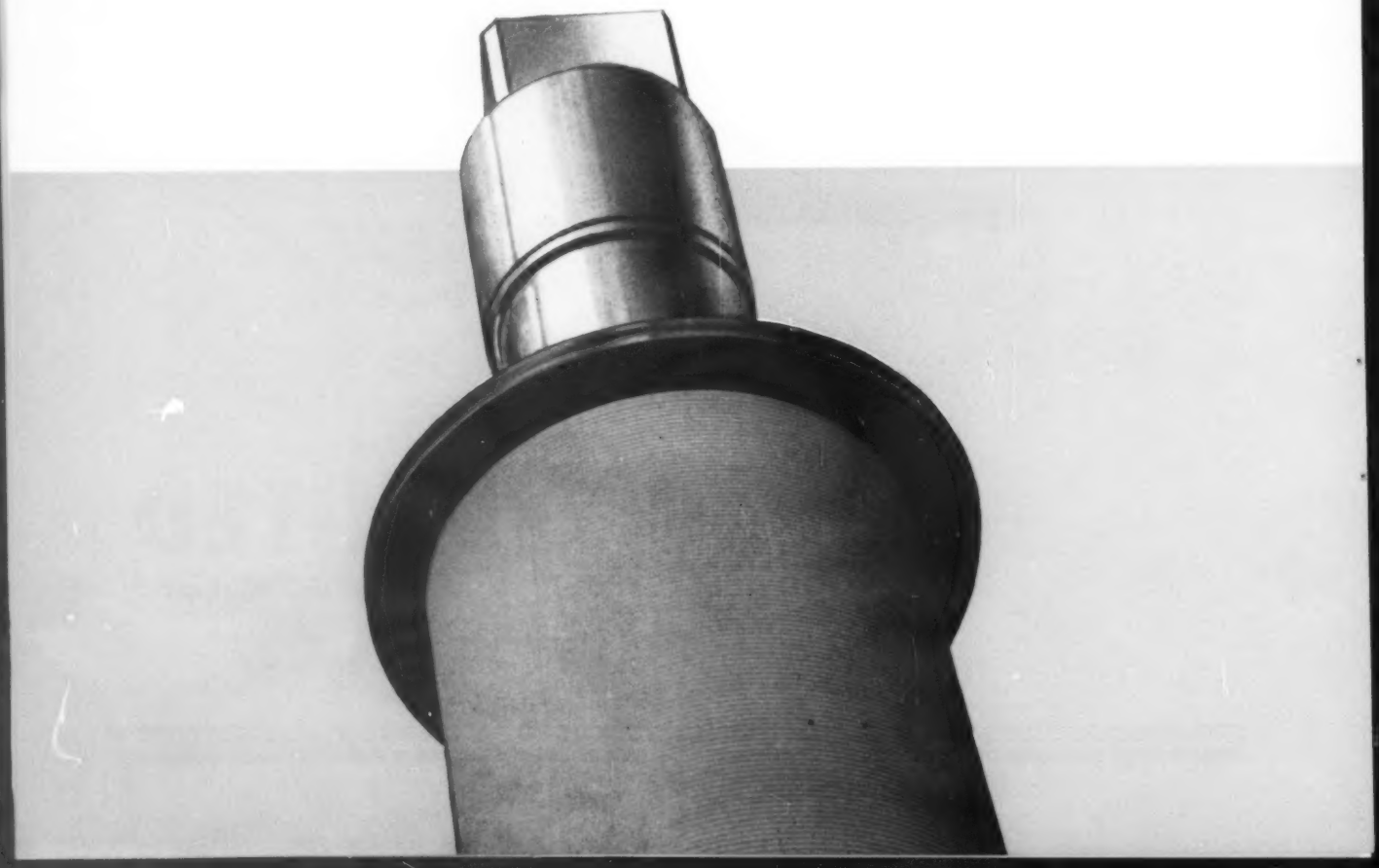

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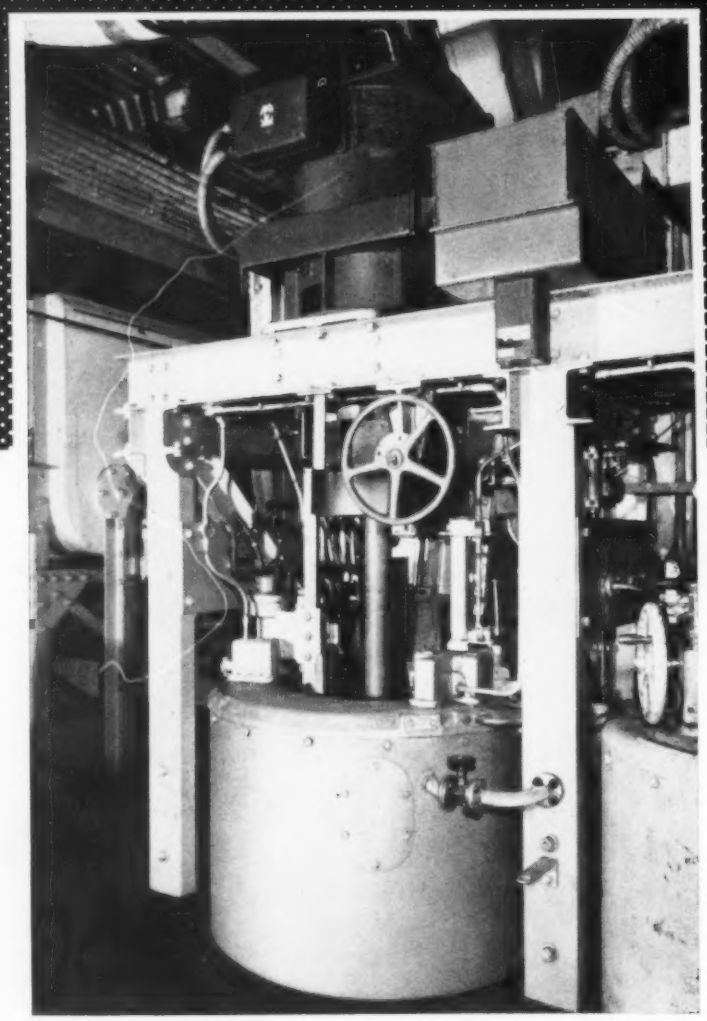

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diluted 10–100 times with water and 1 ml of the solution containing 1–6 μg amino acid nitrogen is transferred to a clean, dry, graduated test tube. One ml of the Moore and Stein ninhydrin:hydrindantin reagent is added, the solutions are mixed for 30 sec and the tube is placed in a boiling water bath for 15 min. After cooling, the mixture is diluted to 10 ml with 50% aqueous isopropanol and shaken vigorously for 10 sec. The optical density of the solution is then measured at 570 mμ in comparison with that produced from standard solutions of glutamic acid.

The variation between the absorption of the standard and that of the principal amino acids in juices, including γ-amino butyric acid, is within ± 2% and ammonia nitrogen is also determined quantitatively. The ammonia content of beet is normally negligible but for process juices it is necessary to deduct from the measured value the ammonia nitrogen as determined by reduced pressure distillation from borate buffer.

The value so obtained has been found to be much more closely correlated with the sum of the individual amino acids than is the Stanek-Pavlas value.

Amide nitrogen

The principal amino acid, glutamine, represents 50–80% of the amino acids in beet and the concentration of glutamine approaches that of betaine in raw juice, being about one-sixth to one-tenth of the total non-sugars.

Glutamine is of special importance in processing as the amide is progressively deamidated to yield pyrrolidone carboxylic acid and, to a much smaller extent, glutamic acid.

Only the amino group of glutamine reacts with the Moore and Stein reagent but by hydrolysis of the stoichiometrically equivalent amide group, glutamine, together with asparagine, can be determined.

The sample of pressed juice or beet extract, equivalent to 25 ml of raw juice, is distilled with sodium hydroxide[12] and the liberated ammonia is absorbed in 4% boric acid and determined by titration with N/100 hydrochloric acid.

For process juices it is first necessary to remove uncombined ammonia by reduced pressure distillation from borate buffer but this stage may be considered unnecessary with beet extracts or pressed juice because of the relatively low ammonia content of beet.

In most years asparagine is only present in British beet at low concentration but in the abnormally dry 1959 season asparagine increased by an amount relatively greater than the increase in bulk amino-acids. For this particular year the amide nitrogen value included an appreciable amount of asparagine although by far the larger proportion represented glutamine. Asparagine is rather more resistant to hydrolysis than glutamine but the effect of the two amides in contributing to loss of alkalinity is very similar.

Pyrrolidone carboxylic acid

As the principal deamidation product of glutamine, pyrrolidone carboxylic acid becomes of increasing significance in the later stages of the factory process and represents between one-sixth and one-tenth of the non-sugars in molasses.

Pyrrolidone carboxylic acid is determined by ion exchange separation and alkaline hydrolysis to glutamic acid which is then estimated with the Moore and Stein reagent as described for amino acids.

The ion exchange separation is identical with that described for the separation of lactic acid[13]. A suitable aliquot of the ion exchange eluate, generally 0·5–4·0 ml, is made alkaline by addition of 2 ml of 5N sodium hydroxide and the total volume is adjusted to 6 ml. The solution is heated in a boiling water bath for 30 min and then cooled, neutralized and diluted to 20 ml. The glutamic acid content is determined directly on a 1 ml aliquot of this solution using the Moore and Stein reagent.

Anions

Total anions may be determined by titration of the effluent obtained after removing bases and amphoteric substances on a strong cation exchange resin such as "Zeokarb 225" or "Amberlite IR 120".

The filtered aqueous beet extract is passed through a strong cation exchange resin, in the hydrogen form, to remove cations and amino acids. A ratio of 4 ml resin per g of sucrose is required and the resin should then be washed with two resin volumes of water. The eluate and washings are titrated with 0·1N sodium hydroxide to determine total acids. The system is buffered by the weak polyvalent acids in the extract and the end point is therefore best determined by pH measurement. A convenient end point for calculating the number of equivalents of total acid is the pH either of the raw juice or of thin juice.

The total anion content in meq as measured will be less than the total of the cations because of the base requirement of the amino acids and any other amphoteric compounds removed by the resin.

Specific methods for the determination of individual anions are recorded in the Appendix.

Invert

The degradation of invert sugar during defecation and evaporation results in increased colour and acid concentration in juice and is therefore an important factor in assessing beet quality. Invert can be determined by the tetrazolium method of CARRUTHERS and WOOTTON[14] after deleading the half normal lead extract used for polarization. Although neutral lead is normally to be preferred for invert determinations, because of the reduced danger of precipitating fructose, the error involved in using basic lead in the normal beet macerate is not sufficient to justify the preparation of a separate extract using neutral lead.

(*to be continued*)

[12] VARNER *et al.*: *Anal. Chem.*, 1953, **25**, 1528.
[13] SHORE: *Proc. 10th Meeting Comm. Int. Tech. Sucr.*, 1957, 196; *I.S.J.*, 1958, **60**, 24.
[14] *I.S.J.*, 1955, **57**, 193.

STRUCTURE OF COAGULATED COLLOIDS OF SUGAR BEET JUICE

(I) Volume and shape of hydrated mud particles of progressively predefecated juice

By RUDOLF KOHN and ZORA KOHNOVÁ

(Czechoslovak Academy of Sciences, Chemical Institute, Slovak Academy of Sciences Bratislava, Czechoslovakia)

(*Continued from page* 81)

Results and Discussion

Determination of volume of hydrated mud particles of progressively predefecated juice

The volume determination of hydrated mud particles was carried out with a series of samples. Table I shows the analysis of primary diffusion juice as well as the conditions of predefecation. The temperature and diffusion time in the laboratory diffuser were chosen so that the individual samples of juice should differ in their contents of colloids, mainly pectins, from each other. N_c = total nitrogen, N_k = nitrogen in colloids. The diffusion juice was predefecated by a lime sucrate solution.

For the progressively predefecated juice we determined:—

1. the sedimentation volume after 24 hours S (% vol.; the hot turbid juice was left to settle in the laboratory without maintenance of a constant temperature);
2. the mud volume after centrifuging of the turbid juice C (% vol.; centrifugal acceleration a = 1000 to 1300 g; centrifuging time 10 to 15 min);
3. the true volume of hydrated mud particles V_i (% vol.) by the indicator method;
4. the apparent volume of hydrated mud particles V_c (% vol.) by the conductimetric method (the calculation was made on the assumption that the particles were spherical; $X = 2$); and
5. the density of hydrated mud particles d (g/c.c.).

The results of the measurements are given in Table II. According to the composition of the diffusion juice, the sediment of the predefecated juice (S) varies within the limits 24–34 vol %, the volume of the predefecating mud after centrifuging (C) within the limits 4–6% vol., while the true volume of hydrated mud particles (V_i) is only 0·3 to 0·4 vol%. From the comparison of these quantities it is obvious that the sediment has an approximately 70 to 80 times larger

Table I

Sample	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Diffusion Juice—								
source	*factory*			*laboratory*				
refractometric solids (°Bx)	17·0	19·9	18·6	15·2	15·5	13·8	15·4	15·1
purity (Q)	89·1	89·4	89·8	89·4	89·9	87·3	87·6	87·8
acidity (−%CaO)	0·034	0·033	0·029	0·018	0·019	0·019	0·024	0·023
pH	—	—	—	—	—	—	6·13	6·35
colloids K/100 P (g)	2·31	2·44	2·52	2·09	3·50	4·75	2·82	3·22
N_c/100 P (g)	—	—	—	—	—	—	0·526	0·546
N_k/100 P (g)	—	—	—	0·064	0·067	0·075	0·075	0·061
polygalacturonic acid/100 ml (g)	—	—	—	0·043	0·066	0·170	0·108	0·168
Progressive predefecation—								
temperature (°C)	85	85	85	85	85	85	80	80
time (min)	10	10	10	10	10	10	10	10
alkalinity (%CaO)	0·32	0·28	0·30	0·26	0·25	0·22	0·113*	0·137*
pH	—	—	—	—	—	—	11·4	11·35

* alkalinity of clear predefecated juice

Table II

Sample	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
S vol. %	28·2	27·1	23·9	—	—	34·1	28·1	28·0
C vol. %	4·2	4·8	4·0	4·55	4·7	6·05	5·9	4·5
V_i vol. %	0·330	0·394	0·328	0·295	0·406	0·416	0·395	0·400
	—	(±0·006)	(±0·001)	(±0·005)	(±0·001)	(±0·017)	(±0·010)	(±0·013)
V_c vol. %	—	—	—	0·481	0·628	0·636	0·660	0·603
	—	—	—	(±0·004)	(±0·012	(±0·017)	(±0·008)	(±0·012)
S:V_i	85	69	73	—	—	82	71	70
C:V_i	12·7	12·2	12·2	15·4	11·6	14·5	14·9	11·3
V_c:V_i	—	—	—	1·63	1·55	1·53	1·67	1·51
d g/c.c.	1·78	1·67	1·64	1·76	1·78	1·73	1·73	1·73
factor X	—	—	—	0·69	0·75	0·77	0·66	0·79

volume than the real volume of the hydrated mud particles (S:V_i), the mud volume being after centrifuging about 12 to 15 times larger (C:V_i).

The volume dependency of hydrated mud particles of progressively predefecated juice on the contents of colloids in the diffusion juice, expressed in g/100 ml is shown in Fig. 3. The hydrated mud particle volume of the predefecated juice rises with higher contents of colloids in the diffusion juice. The dependency, however, is not directly proportional. This fact, as well as the dispersion of results, is connected with the basic inadequacy of the method of determining colloids[9]. By adding a significant excess of alcohol other materials besides colloids are precipitated (especially in juices prepared from long-stored deteriorated sugar beet), which are not coagulated by $Ca(OH)_2$; there is also marked adsorption of salts on colloids precipitated with alcohol.

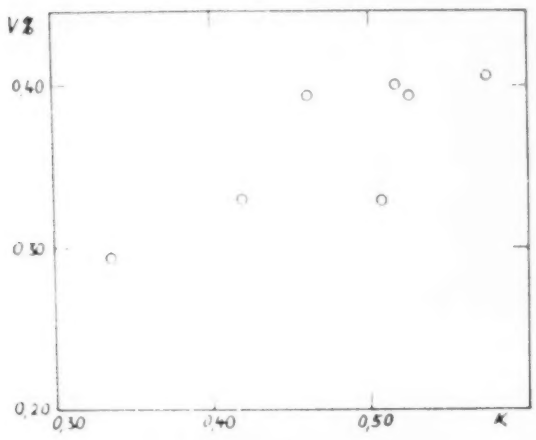


Fig. 3

The volume of hydrated mud particles of progressively predefecated juice and colloid contents in diffusion juice.

Abscissae : K, the colloid contents in diffusion juice (g/100 ml).

Ordinates : V, the total volume of hydrated mud particles vol. %.

The volume of hydrated mud particles of progressively predefecated juice is very small—0·3 to 0·4%. In spite of this a large sediment volume as well as a large mud volume results after centrifuging. To explain this fact we must refer to the colloido-chemical reactions which take place in the clarification of sugar beet juice and first of all determine more closely the shape of mud particles and their grouping in space.

Determination of Shape of Mud Particles

Determination of shape of mud particles with the aid of factor X

From the different results obtained in the determination of hydrated mud particle volume with the aid of the indicator method and conductimetric method (Table II) we may judge that in no case are particles of sphere shape involved, as by the selection of factor $X=2$ (sphere) we obtain significantly higher results. Then the volume of mud particles determined by the conductimetric method is roughly 1·53–1·67 times higher (V_c:V_i) than is their real volume determined by the indicator method.

The real factor X was calculated with the Fricke equation (1) in the above-mentioned manner; the quantity ϕ was determined independently by the indicator method. The values of factor X for individual samples of the predefecation mud varied from 0·69 to 0·79 (Table II).

Fricke[13] states, for example, that for elongated rotating ellipsoids ($\frac{a}{b}=4$, $k_2=0$) factor $X=1{\cdot}65$; for rotating ellipsoids of lentil shape ($\frac{a}{b}=\frac{1}{4}$, $k_2=0$) factor $X=1{\cdot}08$ (Figs. 1 and 2). By determining factor X, however, we still cannot decide which of the two different types of rotating ellipsoids the shape of particles of the tested suspension resembles. This has yet to be found by another independent method as will be shown later.

The predefecation mud presents a polydispersal suspension, with particles of different size and shape, where as well as coagulated colloids of sugar beet juice we also find insoluble calcium salts of organic and inorganic acids, contained in the original diffusion juice. For this reason no deductions of a quantitative character are made from the experimentally determined factor X.

On the basis of the above results the following conclusion can be drawn: in consequence of the relatively very low value of the experimentally determined factor X it follows that hydrated mud particles of progressively predefecated juice have a *significantly anisometric shape*, i.e. one of their dimensions markedly varies from the other two. There may be e.g. particles of rod shape, fibrous particles, elongated rotating ellipsoids or markedly flat ellipsoids, lentil shapes, etc.

Determination of mud particle shape based on studies of different sphere configurations and rotating ellipsoids in space

The sediment of turbid predefecated juice after 24 hours of sedimentation can be considered after the first approach as a stable dispersal system with a loose space structure having evenly distributed particles without individual flocks or aggregates of particles. (See e.g. [16].) On the assumption that mud particles are of spherical shape we can, by determination of their total volume, calculate what volume the sediment would have with different spacial arrangement of these spherical particles. By comparing the calculated sediment volume with its real volume we obtain some idea of the shape of mud particles.

[16] Kurgaev: *Koll. Zhur.*, 1957, **19**, 72.

A number of authors have dealt with the study of the configuration of spheres in space (for literature see [17, 18]). In the closest theoretically possible grouping of spheres, these occupy 74% of the total space [$\varphi = 0{\cdot}74$ and $\nu = 6$, where ν = the packing number (half the number of contact points with neighbouring spheres) and the volume which is taken by particles in the tested suspension in vol % is expressed by 100ρ]. At the loosest grouping of spheres so far known, which still conform to the conditions of stability (HEESCH-LAVES system[19]), the spheres take up only 12·5% of the space ($\varphi = 0{\cdot}125$, $\nu = 2$). HRUBÍŠEK, on the basis of his extensive mathematical study deduced the following values: $\varphi = 0{\cdot}57$, $\nu = 3{\cdot}2$[17], for the probable configuration of spheres in space occurring on free settling owing to gravitation without any external interference. The results of his calculations agree well with values which were determined directly experimentally on model tests by SMITH *et al.*[20]. These authors found the values to be $\varphi = 0{\cdot}555$ and $\nu = 3{\cdot}5$.

The closest practical sphere grouping in space was attained in model tests by WESTMANN and HUGILL[21] with lead balls, poppy-seed, and sand grains of ball shape by sedimentation with simultaneous vibration of the tested system. This configuration of balls was characterized by the quantities: $\varphi = 0{\cdot}62$, $\nu = 4$.

If we know the total volume of particles it is easy to calculate for any φ value the volume of the whole dispersal system, i.e. the sediment volume of ball-shaped mud particles at their different grouping in space.

Table III shows results of some calculations. With the sedimentation of hydrated mud particles of their own total volume $V_0 = 0{\cdot}30 - 0{\cdot}40\%$ we get the sediment $V_1 = 24 - 34$ vol. %. Let us presume these mud particles to be sphere-shaped. For the loosest stable configuration of spheres in space corresponding with their volume V_0 we get the sediment $V_2 = 2{\cdot}4 - 3{\cdot}2$ vol. %. This theoretical configuration (HEESCH-LAVES system) is most unlikely, however, and it is therefore necessary to compare the sediment $V_1 = 24$–34 vol. % with the sediment volume of the spheres at their free setting owing to gravitation, $V_4 = 0{\cdot}53$–$0{\cdot}70$ vol. %. By centrifuging the mud suspension we obtained a volume $V_3 = 4$–6 vol. %, which is comparable with the sediment volume of spheres of the most compact grouping of particles, $V_5 = 0{\cdot}48$–$0{\cdot}65$ vol. %.

Table III

Volume of hydrated mud particles of predefecated juice	V_0 vol. %	0·30—0·40
Sediment volume of predefecated juice after 24 hours	V_1 vol. %	24·0—34·0
Sediment volume of spheres at loosest stable grouping in space (*Heesch-Laves* system; $\nu = 2, \phi = 0{\cdot}1235$)	V_2 vol. %	2·4—3·2
Sediment volume of predefecated juice under a centrifugal force of 1000—1300 *g*	V_3 vol. %	4·0—6·0
Sediment volume of spheres under gravity ($\nu = 3{\cdot}2$; $\phi = 0{\cdot}57$)	V_4 vol. %	0·53—0·70
Sediment volume of spheres at most compact grouping experimentally determined ($\nu = 4$, $\phi = 0{\cdot}62$)	V_5 vol. %	0·48—0·65
Sediment volume of spheres at most compact theoretical grouping ($\nu = 6{\cdot}0$; $\gamma = 0{\cdot}74$)	V_6 vol. %	0·41—0·54

The fact that V_1 and V_3 are several times higher than V_2 and V_4, and V_5, respectively, is proof that the mud particles can not be sphere-shaped. From this theoretical consideration we arrive at the same conclusion as on grounds of determination of factor X, i.e. hydrated mud particles are of significantly anisometric shape.

Though the volume of hydrated mud particles is very small the sediment of progressively predefecated juice settled under gravity occupies quite a large volume. The volume concentration of hydrated particles in this sediment is only 1·2 to 1·4 vol. %. It is therefore necessary to show on model configurations of anisometric particles how the porosity of the system or the volume concentration of particles depends on their shape at a certain grouping of particles in loose stable structures.

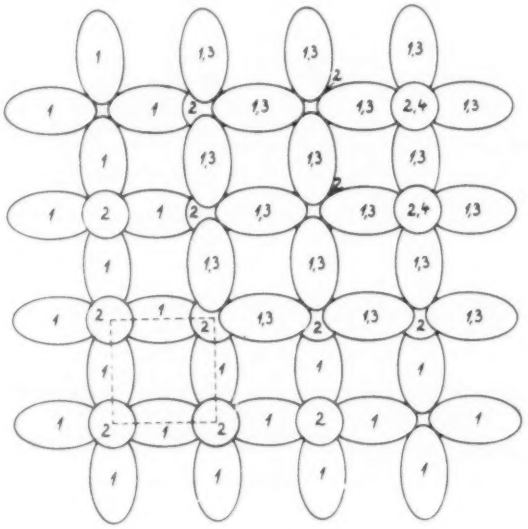


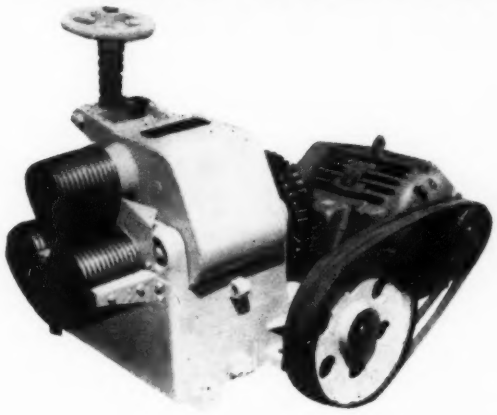
Fig. 4
The configuration of rotating ellipsoids—System I

While a lot af attention has been paid to the study of the geometry of grouping of spheres in space the problems of grouping of ellipsoids in space have so far not been solved. We therefore dealt with this problem in detail. The results of the mathematical analysis are published in the study by R. KOHN, "The grouping and aggregation of ellipsoids in space". In this study some simpler configurations of general

[17] *Kolloid Beihefte*, 1941, **53**, 385.
[18] *Koll. Zeitsch.*, 1961, **174**, 50.
[19] *Zeitsch. Kristallogr.*, 1930, **82**, ref. 17 ; ibid., 1933, (A) **85**, 443.
[20] *Phys. Rev.*, 1929, **34**, 1271.
[21] *J. Amer. Ceram. Soc.*, 1930, **13**, 767.

Suma Products

CANE AND BAGASSE ANALYSIS



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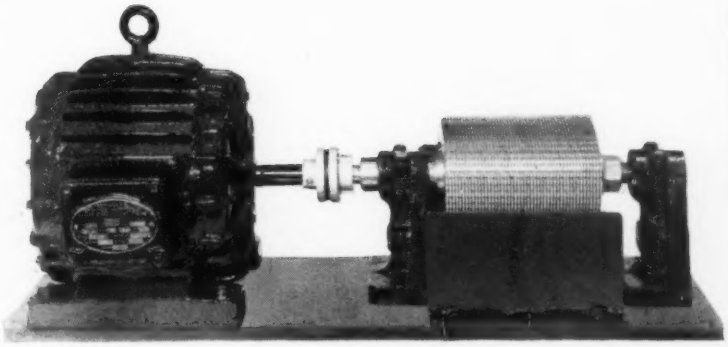

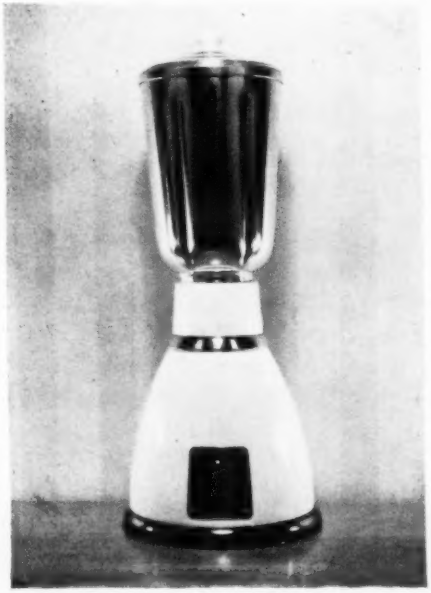

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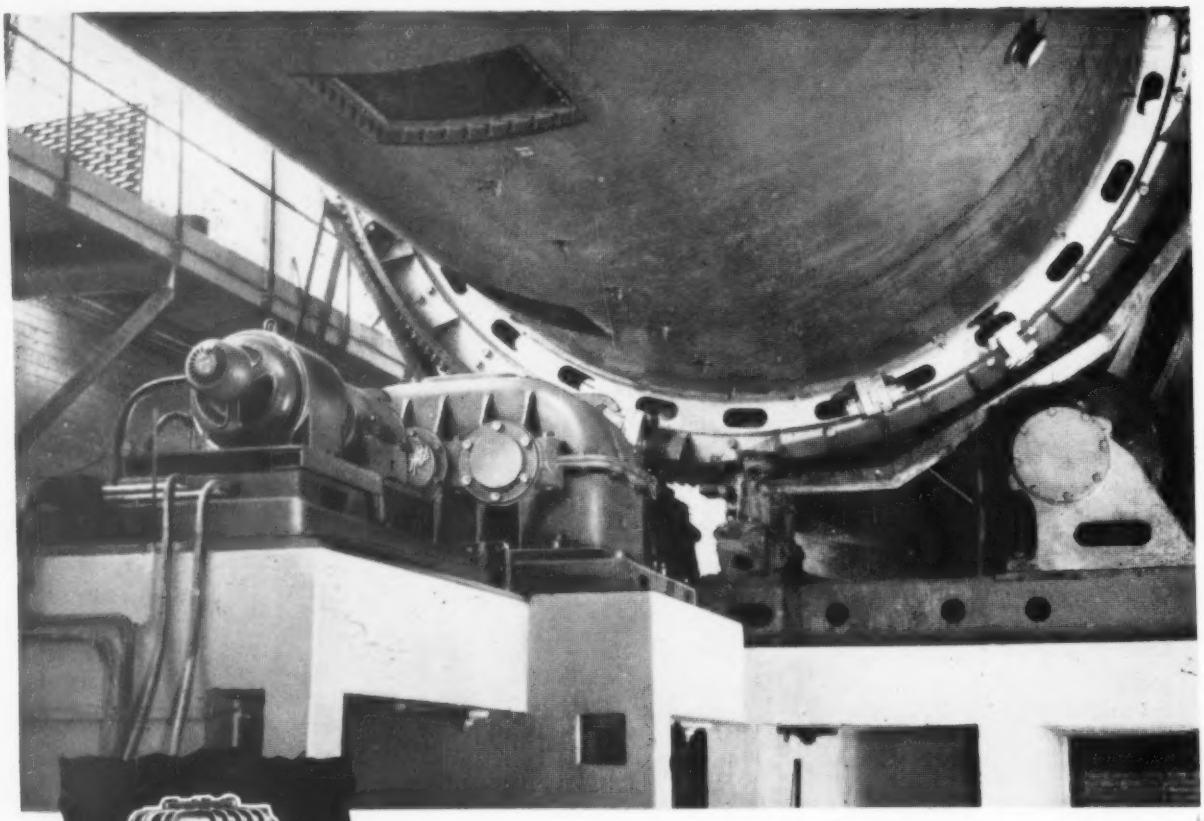

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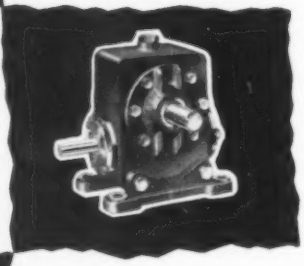

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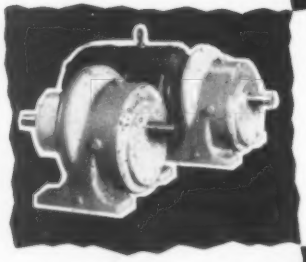

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ellipsoids in space with a close grouping of particles[18] as well as some typically more complicated configurations of rotating ellipsoids in so called loose structures[22] are discussed. These configurations are shown in Figs. 4, 5, 6. Fig. 4 illustrates configuration I, in which the long axes of rotating ellipsoids are placed in the edges of the cube ($\nu=4$). Fig. 5 illustrates configuration II, at which the rotating ellipsoids are grouped similar to the distribution of carbon atoms

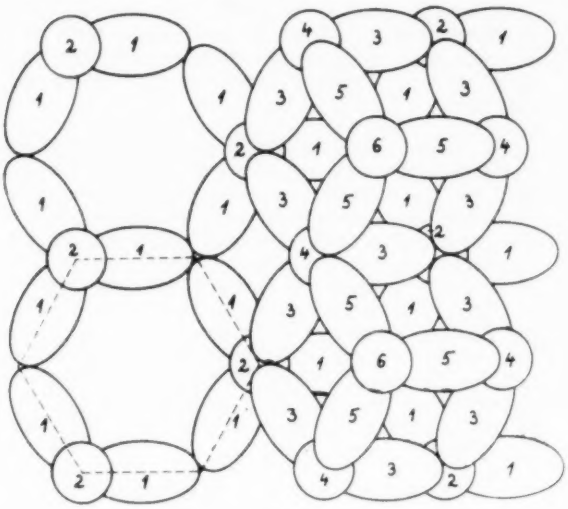


Fig. 5.
The configuration of rotating ellipsoids—System II.

in a diamond. The long axes of ellipsoids are placed in the directions of C-atoms bond ($\nu=3$). Fig. 6 describes configuration III, which represents the

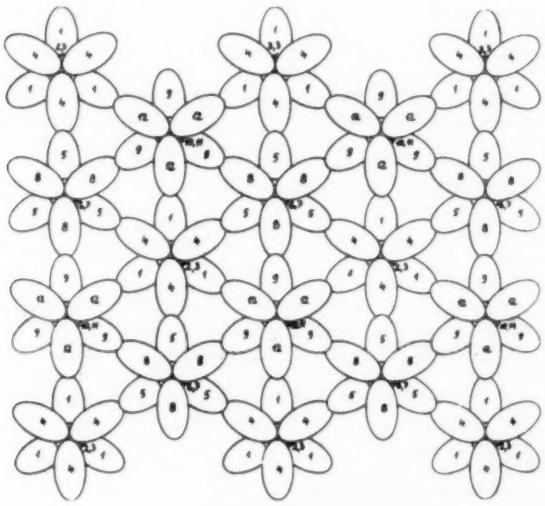


Fig. 6
The confiuration of rotating ellipsoids—System III
(*The loosest stable grouping of rotating ellipsoids in space*)

loosest grouping of ellipsoids in space, still agreeing with the conditions of stability; $\nu=2$. (Similar to the HEESCH-LAVES system for spheres.) The ellipsoids of individual layers are marked with their respective numbers.

For each of these configurations we calculated how the particle volume concentration (ϕ) changes if, at a constant volume of particles, we change only their shape from spherical to significantly elongated rotating ellipsoid. We also examined how the total volume of the dispersal system (sediment) will change with these configurations if we change the shape of particles at their constant volume.

The results of the analysis are described in Fig. 7. The quantities ϕ and (S/S_0) are illustrated as functions of the relation between the long axis of the rotating ellipsoid c (axis of symmetry) and the short axis a; $(\frac{c}{a}=f)$. The expression S/S_0 denotes by how many

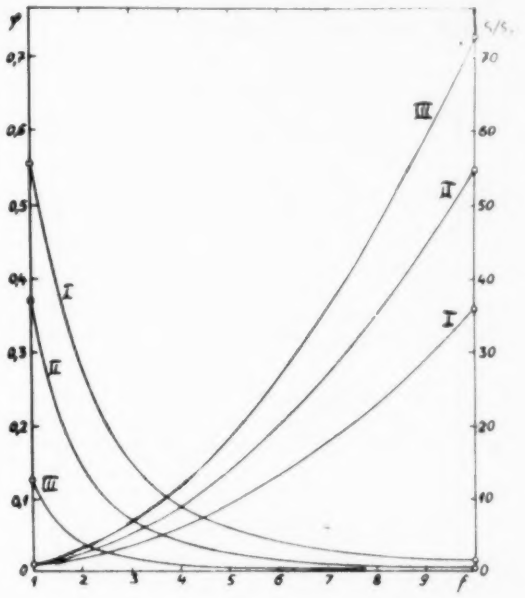


Fig. 7

The dependency of the volume concentration of rotating ellipsoids ϕ and quantity $\frac{S}{S_0}$ on the value of the half-axis ratio of the ellipsoid f for Systems I, II, and III.

Abscissae : $f=\frac{c}{a}$

Ordinates : $\phi; \frac{S}{S_0}$.

times the total volume of the dispersal system (sediment) at a given configuration of rotating ellipsoids is larger in comparison with the total volume of the system of the same configuration of spheres in space.

[22] KOHN: *Koll. Zeitsch.*, 1961, **174**, 59.

So for example for $f=5$ the volume concentration of particles in systems I, II, III is 5·9; 2·6 and 0·67 vol. %; for $f=10$ only 1·5; 0·68 and 0·17 vol. % while for the same grouping of spheres we obtain much higher values: 55·5; 37·0 and 12·35 vol. %. Similarly, but in a reverse manner, the total volume of the dispersal system (sediment-S/S_o) changes if, at a constant volume of individual particles, we change their sphere shape into elongated ellipsoids. The volume concentration of particles ϕ in loose structures of this type therefore rapidly reduces with the degree of elongation of rotating ellipsoids the smaller is the bond number ν.

Similar loose structures, even if more compact in comparison with the previous ones, can be formed by flat rotating ellipsoids of lentil shape ($c<a$), or plates. The loose sediment structure of particles of clay, bentonite, kaolin, etc. can serve as an example, where the aggregated particles are of plate shape.

Such a loose structure, which is similar to a "house of cards" is illustrated in Fig. 8[23].

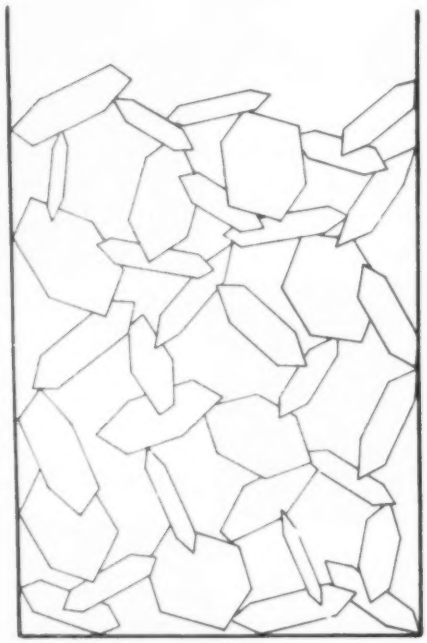


Fig. 8

Loose structure arrangement of kaolin particles sediment[23]

We have shown that loose structures with a very small volume concentration of particles stable in the field of gravity are possible only when they are anisometric particles, significantly elongated or significantly flat particles.

Determination of mud particle shape on basis of sedimentation under different centrifugal forces

In the preceding part we proved on basis of determination of factor X and the study of different configurations of spheres and rotating ellipsoids in space that hydrated mud particles of progressively predefecated juice are anisometric. One of their dimensions differs significantly from the other two. It is necessary to determine whether they are particles of elongated shape similar to e.g. rotating ellipsoids, sticks, or fibres or flat rotating ellipsoids of lentil shape etc. This problem may be solved by examining the sedimentation of mud particles under different centrifugal forces.

The above described configurations of elongated rotating ellipsoids (loose structures) represent groupings which are stable even when subject to force. The stability of these model structures is possible because a homodispersal system is concerned with an absolutely regular arrangement of particles in space. With natural suspensions having a loose structure it is often a matter of heterodispersal systems with different particle shapes irregularly arranged in space. The stability of such a structure depends, then, in addition to adhesive forces binding the particles in aggregates, on the gravitation and especially on the value of the centrifugal force with which we influence the system.

If a dispersal system of rotating ellipsoids of a not too elongated shape or rotating ellipsoids of lentil shape is concerned we can rightly presume that with centrifugal acceleration of e.g. 700 to 1000 g we get a sediment of a relatively large volume concentration of particles near to $\phi=0{\cdot}4$–$0{\cdot}5$[18]

Where the particles resemble significantly elongated rotating ellipsoids (e.g. $\frac{c}{a}>10$) or have a stick or fibre shape a mechanical knitting-together of particles may occur during sedimentation to form a space network structure which may be markedly resistant to compression when centrifuging. Less elongated particles may also form a loose structure resistant to compression but only if the adhesive force of their aggregation is sufficiently great.

With particles similar to flat rotating ellipsoids or plates the forming of a mechanically-knit space network structure, such as that mentioned above, cannot occur for geometrical reasons. By centrifuging with only a small centrifugal acceleration, we obtain a sediment with a relatively compact grouping of particles. This is so with e.g. certain clays, bentonites and kaolin, the particles of which are of plate shape. For example kaolin (Zettlitz) consists of plates of average dimensions 500 × 500 × 15 mμ, Ca-bentonite (Geisenheim) 700 x 700 x 15 mμ, and Na-bentonite (Geisenheim) 700 × 700 × 2 mμ[23].

[23] KUHN: Kolloidchemisches Taschenbuch. (Leipzig, 1953) p. 298.

It is obvious that by examining the sedimentation of mud particles of progressively predefecated juice under different centrifugal forces it is possible to determine what type of particle is concerned.

The centrifuging of mud suspensions at the chosen centrifugal acceleration was carried out until the sediment volume was roughly constant. After attaining equilibrium we raised the centrifugal acceleration and continued in a similar manner. Measurements were made at laboratory temperature. The results are shown in Table IV. The centrifugal acceleration a is expressed in multiples of the gravitational acceleration g, V=the volume of the stable sediment at the given acceleration (vol. %), 100ϕ=the volume concentration of particles in the sediment (vol. %), V_o=the total volume of hydrated mud particles (vol. %). The analysis of diffusion juice for samples G and H as well as the conditions of progressive predefecation are shown in Table I.

Table IV

Sample	*G*		*H*	
a	*V*	100ϕ	*V*	100ϕ
1g*	28·0	1·4	28·0	1·4
111g†	7·82	5·0	6·60	6·1
260g	7·38	5·4	—	—
470g	6·82	5·8	—	—
730g	6·24	6·3	4·52	8·8
1070g	5·93	6·7	—	—
18800g	1·93	20·4	1·93	20·8
V_0	0·395	100·0	0·400	100·0

* gravitational acceleration
† centrifugal acceleration

From the above-mentioned results it is obvious that the stable sediment of mud particles of progressively predefecated juice is significantly dependent on centrifugal acceleration. The sediment keeps its loose structure at centrifugal acceleration 1000 g when the volume concentration of particles reaches only 7–9 vol. %. Only at an acceleration of about 19,000 g did we obtain a more compact grouping of particles, at which the particles occupied about 21% of the total suspension volume.

To be able to confirm the corectness of the above, we also followed the sedimentation of the kaolinite suspended in distilled water. The sediment of the kaolinite suspension is a typical representative of loose structure formed by particles of plate shape. (The dimensions of kaolinite and bentonite plates were described above.) The results of the analysis are shown in Table V where the individual symbols have the same meaning as those in Table IV. The volume concentration of kaolinite in the original suspension V_o was chosen approximately equal to the volume concentration of hydrated mud particles in the predefecated juice. The quantity V_o for the kaolinite suspension refers to the volume of particles without considering their hydration. (V_o was determined from the deposit and the density of kaolinite.) But if the hydration of kaolinite particles is also taken into consideration we get even higher values for ϕ_2.

Table V

Sample	*mud suspension*		*kaolinite suspension*		
a	V_1	$\phi_1 \cdot 10^2$	V_2	$\phi_2 \cdot 10^2$	ϕ_2/ϕ_1
1g*	28·0	1·4	6·0	6·4	4·6
110g†	7·82	5·0	1·96	19·7	3·9
730g	6·24	6·3	1·36	28·3	4·5
18800g	1·93	20·4	—	—	—
V_0	0·395	100·0	0·385	100·0	—

* gravitational acceleration
† centrifugal acceleration

From the results shown in Table V it is obvious that by centrifuging the kaolinite suspension a relatively close setting of particles in the sediment is attained at a fairly low centrifugal acceleration. So for example, a volume concentration of particles of about 20% is attained with a kaolinite suspension at only 110 g, whereas with a suspension of mud particles of predefecated juice 19,000 g is required. Similarly we get $\varphi \cdot 10^2$=6·4 vol. % with a kaolinite suspension by its sedimentation in the field of gravity, whereas with mud particles it is necessary to centrifuge the suspension at 730 g. For a given acceleration within the limits of about 1–1000 g a volume concentration of particles about 4–4·5 times greater is attained at the kaolinite suspension than at the suspension of mud particles of predefecated juice.

From results of the observation of the sedimentation of the kaolinite suspension and the suspension of mud particles of predefecated juice in the field of gravity and the field of centrifugal force of different value we come to the conclusion that anisometric mud particles of progressively predefecated juice have a significantly elongated shape which may resemble for example, sticks, fibres, elongated rotating ellipsoids etc.

The space grouping of these primary particles of progressively predefecated juice in mud aggregates as well as their mutual adhesion will be discussed in a subsequent paper.

Summary

In this paper we dealt with the study of structure of sugar beet juice colloids coagulated by the effect of $Ca(OH)_2$ at progressive predefecation.

1. The volume of hydrated mud particles was determined by the so-called indicator method as well as by the conductimetric method of Fricke. The volume concentration of mud particles in progressively predefecated juice is very small: 0·3–0·4 vol. %, depending on the content of colloids in the diffusion juice. The mud particles form at sedimentation a markedly loose space structure of a volume concentration of particles 1·1–1·4 vol. %. The loose structure of the mud is preserved also when centrifuging the suspension; it is significantly resistant against compression due to centrifugal force.

2. By the combination of both above mentioned methods it was possible to determine factor X in the

FRICKE equation, which is characteristic for the shape of particles. From the experimentally determined value $X=0{\cdot}73\pm0{\cdot}03$ it is obvious that mud particles of progressively predefecated juice are anisometric; one of their dimensions significantly differs from the other two. It was not possible to determine however, by this method, whether the particles are of stick shape, fibres, elongated rotating ellipsoids or plates, or rotating ellipsoids of lentil shape etc.

3. We came to the same conclusion by mathematical analysis of values of the sediment volume in the gravitational and centrifugal field and the real total volume of hydrated mud particles. Theoretical deliberations were made on basis of studies of different sphere and ellipsoid configurations in space.

4. The sedimentation of mud particles of progressively predefecated juice and suspensions of kaolinite (as the typical representative of loose structure of plate-shaped particles) in the field of gravity and field of centrifugal force of an acceleration from 1 to 19,000 *g* was followed. The resultant measurements showed that the anisometric particles of progressively predefecated juice are of a significantly elongated shape. They may resemble for example sticks, fibres, or elongated rotating ellipsoids.

The space grouping of these primary particles in mud aggregates as well as their mutual adhesion will be discussed in a subsequent paper. (The papers: "A modified indicator method" and "The grouping and aggregation of ellipsoids in space" have been published as independent studies.)

BASE-BINDING BEHAVIOUR OF THE DIALYSED BROWNING PRODUCTS FROM CANE FINAL MOLASSES

By W. W. BINKLEY

(New York Sugar Trade Laboratory, 37 Warren Street, New York 7, N.Y., U.S.A.)

A GRADUAL increase in the acidity of the mother liquors or molasses occurs during the production of sucrose from cane juice. Both simple and complex acidic organic substances are formed during this process and they contribute substantially to this change. The "browning" polymers are the principal complex acidic substances in cane final molasses. Carbon-14 tracer studies have indicated that some of the acidity in these polymers can be attributed to the carboxyl groups of the constituent amino-acids[1]. In the continuation of our structural studies of the molasses "browning" products, we have titrated electrometrically with sodium hydroxide the dialysed "browning" polymers and wish to report herein our findings.

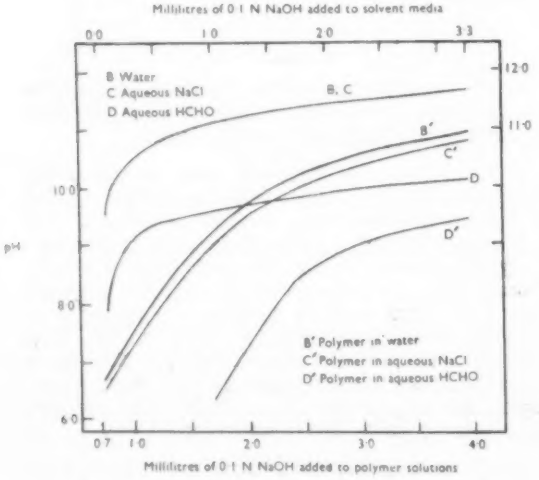


Fig. 1

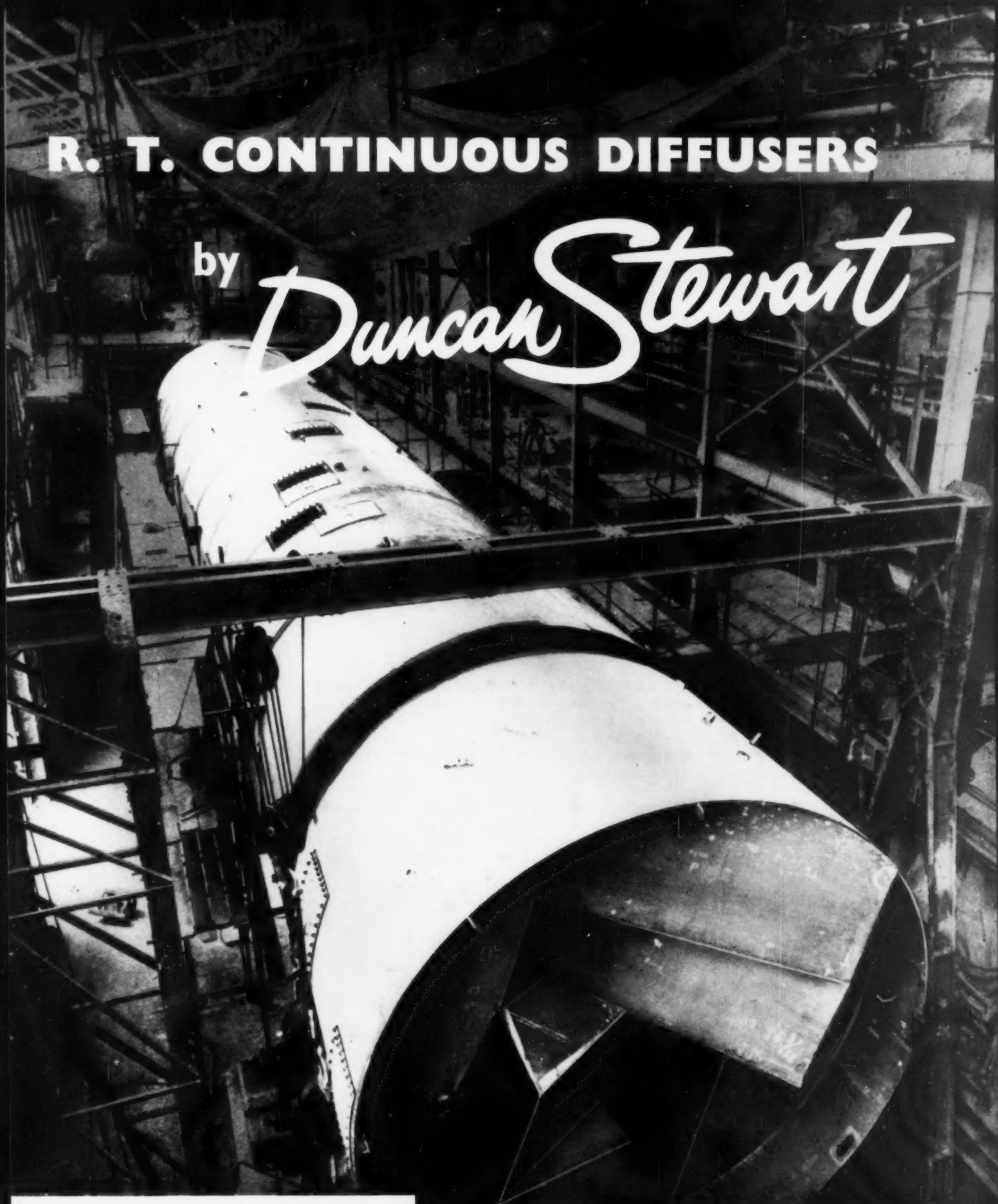
EXPERIMENTAL

The isolation from Florida cane final molasses of the polymer(s) used in this work has been described previously[2]. Separate portions of the polymer were allowed to come to constant weight by standing under reduced pressure at 25°C over phosphoric anhydride.

Electrometric Titrations of the Molasses "Browning" Polymer

(A) *Technique.*—The course of the pH changes during the titrations was followed with a Beckman Model 76 expanded scale pH meter (Scientific and Process Instruments Div., Beckman Instruments Inc., Fullerton, Calif., U.S.A.). The electrodes of the meter were allowed to remain in the polymer solution

[1] BINKLEY: *I.S.J.*, 1959, **61**, 364.
[2] BINKLEY: *I.S.J.*, 1960, **62**, 36.



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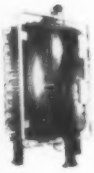

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throughout the titration with 0·1N sodium hydroxide. The polymer solution was stirred mechanically at a uniform rate for two minutes after each addition of the reagent. The stirrer was stopped and the pH measured at 20°C (solution temperature). The results are shown in Fig. 1.

(B) *In water.*—The dried polymer (235 mg) in 50 ml of water and 50 ml of water alone were titrated with 0·1 N sodium hydroxide as described in Section A of the Experimental. Initial adjustment of the pH of the polymer solution to the pH (6·42) of the water alone required 0·70 millimoles of base. These data are collected in Fig. 1.

(C) *In aqueous sodium chloride.*—Dried polymer (228 mg) and sodium chloride (117 mg) in 50 ml of water and 50 ml of water containing 117 mg of sodium chloride only were titrated with 0·1 N sodium hydroxide using the procedure described in the Section A of the Experimental. The resulting data are to be found in Fig. 1.

(D) *In aqueous formaldehyde.*—An amount of 236 mg of the dried polymer was dissolved in 50 ml of 10% aqueous formaldehyde. This solution was titrated with 0·1 N sodium hydroxide employing the method described for the polymer in water. A control titration with this base was then made on a 50 ml portion of 10% aqueous formaldehyde. These results are presented in Fig. 1.

Calculations

The amount of alkali bound (C_1–C_2) by the polymer was obtained from the difference between the quantity of alkali added and that which remained uncombined. Utilizing the data in Fig. 1, the uncombined base was derived from the following equation[3]:

$$\log \frac{C_2}{C_1} = pH_2 - pH_1$$

pH_1 and pH_2 were measured after the addition of C_1 millimoles of sodium hydroxide to identical volumes of the solvent alone and of the solvent containing a known quantity of polymer, respectively; C_2 represented the uncombined alkali. The base bound by 235 mg of polymer after the addition of 0·280 millimoles [0·280—0·070 = 0·210 = C_1] of base was found to be 0·256 [0·070 + 0·186].

$$\log C_2 - \log 0{\cdot}210 = 10{\cdot}51 - 11{\cdot}46$$

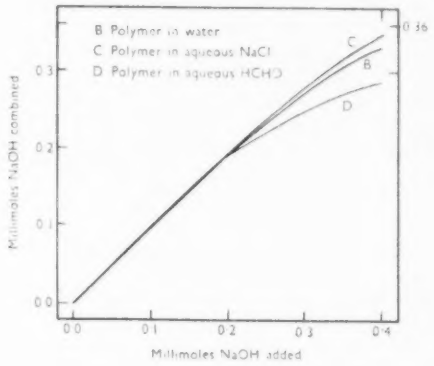
$$C_2 = 0{\cdot}024$$

$$C_1 - C_2 = 0{\cdot}210 - 0{\cdot}024 = 0{\cdot}186.$$

The values from these calculations are collected in Fig. 2.

Discussion

The behaviour in the presence of alkali of the cane molasses dialysed "browning" products was examined in three media, namely, water, aqueous sodium chloride and aqueous formaldehyde. These melanoidins were partially neutralized during sucrose production by available lime and the pH of the clarified dialysed products, 4·62, is that of the acidic salts of these nitrogen-bearing polymers. The results herein reported reflect the alkali utilized by the remaining acidic groups. The plot of the base bound by the polymer(s) in water revealed a heterogeneity of the acidic species (Fig. 2 B); a plateau in the curve would have indicated the presence of a particular dominant acidic group(s). Sodium chloride and formaldehyde exerted distinct influences on the base-binding capabilities of the polymer(s) (Fig. 2 C and D).



Sodium chloride, which had been introduced to enhance the ionic strength of the solvent medium, increased the alkali uptake of the molasses polymer(s) (Fig. 2 C). Ultracentrifugation data showed that the most probable shape of the polymer was that of a random coil[4]. The apparent effect of this salt was to make available in the polymer chain additional acidic sites.

Aqueous formaldehyde was used as the solvent medium in a Sorensen[5] titration of the polymer (Fig. 2 D). An unanticipated decrease in alkali consumption occurred. In this instance the participation of the formaldehyde in the formation of cross-linkages in the polymer chain is likely and these new structures could limit the participation of certain acidic groups.

Summary

The electrometric titration with sodium hydroxide of the cane molasses dialysed "browning" polymer(s) indicated a heterogeneity in the constituent acidic residues. The availability of acidic groups was greater in the presence of sodium chloride. Formaldehyde lowered the base-binding capacity of the polymer(s).

Acknowledgment

The writer wishes to thank Beckman Instruments, Inc., Fullerton, Calif., U.S.A. for the use of their Model 76 pH meter and to acknowledge the consultation of Dr. Alan Chaney* of the Ohio State University in the preparation of the manuscript.

[3] Cohn and Edsall: "Proteins, Amino Acids and Peptides". (Reinhold, New York.) 1943. p. 455.
[4] Binkley: *I.S.J.*, 1960, **62**, 36.
[5] Sorensen: *Biochem. Z.*, 1907, **7**, 45.

* Present Address: Texas U.S. Chemical Co., Parsippany, N.J.

SUGAR-HOUSE PRACTICE

Effects of degree of preparation on the Queensland experimental mills. C. R. MURRY and D. S. SHANN. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 122–131.—An investigation of the effects of fineness of preparation (using bulk density at a selected test pressure as the measure) was carried out using the two- and three-roller Queensland mills. Results with both mills were in good agreement. In general, juice extraction increases with increasing fineness of preparation, while energy consumption decreases; however, this decrease is more than counterbalanced by the energy consumption of the shredder. Using a wide range of preparations for the two-roller mill, it was observed that there was a general but small increase in the ultimate self-feeding milling rate with increasing fineness of preparation.

* * *

Employment of steam turbines in cane sugar factories. K. S. ARNOLD. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 135–145.—Replacement of large electric motors in the sugar factory with small single-wheel and multi-stage turbines is considered feasible and to have marked advantages in flexibility and convenience. In a study of the economics, capital costs and steam consumption are compared for 250 and 450 h.p. electric motors (driven by power supplied through the power station turbo-alternator), and single-wheel and multi-stage steam turbines of the same ratings. Capital costs were very much lower for the turbines, while steam consumption was the same for the more efficient multi-stage turbine and slightly higher for the single-wheel turbine. Other factors are: that replacement of centrifugal motors would prevent power consumption surges; that multiplication of turbines would minimize spares stocks, and that the size of the power station turbo-alternator could be reduced, perhaps using turbines identical to those used, e.g. at the mills, so extending standardization.

* * *

Automatic weighing of bagasse in cane sugar factories. S. L. PHANSALKAR and H. C. BHATTACHARYA. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 146–150.—A laboratory weigher is described on which a factory-scale weigher is to be based. A conveyor carrying bagasse feeds alternately to two baskets carried by weighbridges. At predetermined weights, movement of the weighbridges actuates microswitches, which open the emptying doors of the filled basket and direct the feed to the other basket. A counting mechanism provides the total number of baskets filled and hence the total weight. Accuracy is to within $\pm 0{\cdot}5\%$.

* * *

Installation and operating features of an automatically-controlled steam engine driven main cane carrier. J. R. GUNN. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 150–155.—The controls described operate two steam valves on the cane carrier engine. When one is open, the carrier "creeps" and when both are open the carrier moves at full speed; this is simpler than, and as satisfactory as, continuously variable travel of the carrier. The steam valves are operated by solenoids which are governed by the quantity of prepared cane being supplied to the crusher (measured by a killer-plate in the crusher chute), and by an overload on the cane knife motor (detected by means of two current transformers installed on one phase of the motor and connected to a current relay). A time-delay relay is actuated by the small steam valve circuit and imposes the delay on the large valve circuit; this prevents "hunting" between the valves when overload conditions are being cleared. In addition, a manual over-riding control is built into the system.

* * *

Automation of main cane carriers in sugar cane factories. R. DESMARAIS. *Proc. Congr. I.S.S.C.T.*, 1959, 155–162.—Prior to the adoption of electric motor drive at Flacq United Estates Ltd., cane carriers were steam engine driven with crude control, and cane knives were frequently overloaded to choking. By use of a squirrel-cage 3-phase motor, driving through a Heenan & Froude slip coupling and a Crofts worm reduction gear, an output speed, infinitely variable from zero to the maximum, was obtained, and the carrier operator was able to maintain a uniform flow of cane to the knife. Following from this, by mounting current transformers on a phase-lead of each knife motor, and connecting the secondary output of each to a control box, the knife motor level could be set to actuate the slip coupling fitted to the main carrier drive; this prevents knife chokes automatically. It is considered that the sensitivity and flexibility of slip-couplings combined with electric drive make these more suitable for mill drive than steam turbines.

* * *

Cane payment in Mauritius. J. DUPONT DE R. DE ST. ANTOINE. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 163–167.—The method used in Mauritius with slight modifications since 1940 is described. Individual tests are used for planters' supplies of 10 minutes' crushing or more, and a sample of 90 canes are withdrawn from the carrier. These are sub-sampled to yield 30 canes which are then cut into top, middle and bottom thirds. Half of each portion is finely shredded in a "Cutex" fibrator, the fibrated material mixed, and a portion weighed, placed in a calico bag and leached in cold running water for 24 hr, followed by drying to constant weight at 110°C. A correction is applied for trash delivered with the cane. A sample of first expressed juice is also taken and its Brix and apparent purity determined. The techniques for calculating the sucrose content of the cane are described, together with means of allowing for the relationship between absolute and first expressed juice purity, crushing outside the optimum maturity period so as to maintain adequate cane supplies to the factory, etc.

Quality determinations of cane—experiments in India. S. N. GUNDU RAO, N. C. VARMA and R. C. SHARMA. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 174–181.—A description is given of the current system applying in India, where cane is paid for solely on a weight basis, and a new Government-sponsored development whereby cane is paid for on a basis of its sucrose content as well as weight. Details are provided of the means of identifying the cane lot (which may be as small as 1½ tons) and obtaining an automatic juice sample for analysis. Difficulties encountered are listed together with recommendations for improving the system.

* * *

The juice scales—individual fibre system for the determination of cane quality. G. A. ANDERSON. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 181–187.—Under present-day conditions in Australia, as a result of mechanical harvesting, varietal changes and delays between burning and milling, the standard c.c.s. system gives inaccurate results. The use of juice weight control together with individual farmers' fibre analyses in place of average mill fibre analysis gives more accurate values which would encourage farmers to supply clean and fresh cane.

* * *

The Queensland system of cane payment. J. L. CLAYTON. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 205–212.—A comprehensive account is given of the background of the Queensland system of cane payment on the c.c.s. basis, together with details of the techniques used, variations and developments, and requirements to enable the system to be adapted to present and future conditions.

* * *

The effect of starch on clarification and raw sugar filtrability. R. I. NICHOLSON. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 213–221.—Experiments are described on determination of the effect of the presence of a normal amount of starch on clarification and raw sugar filtrability, together with the effects of removing and adding cane starch. Starch was found to affect clarification only little of itself, although high-starch juices usually contained high phosphate and so clarified well. Examination of raw sugar filtrabilities and starch content showed a relationship significant at the 2% level which does not appear therefore to be a causal relationship. However, highly significant relationships at about the 0·1% level were found between filtrability differences and phosphorus content and between starch and phosphorus content. Starch removal by enzymatic methods was examined, up to 80% removal being achieved; however, only in two cases was filtrability improved and this was also achieved by use of formamide (as in the removal technique) without starch removal. Addition of potato starch to cane juice before carbonatation gave little evidence of strong adsorption by $CaCO_3$ or of agglomerate size reduction. High viscosity starch added to cane syrup was easily adsorbed by both coarse and finer filter-aids; when the starch was less viscous (i.e. more finely dispersed), it was allowed to pass through a coarse particle bed but was trapped by a fine particle bed. Thus starch easily brought to a high degree of dispersion has little effect on filtrability.

* * *

Improved process of two boiling scheme. G. FUNDORA and M. A. MASCARÓ. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 228–231.—In the process patented by the authors, an *A*-massecuite of 83–85 purity yields a commercial sugar of 97·5–98 pol without washing; the *B*-massecuite is of 59–60 purity and yields seed sugar and final molasses. The *A*-massecuite is brought rapidly to 130–135°F in water-cooled crystallizers and is then reheated to saturation temperature before purging. The *A*-molasses, concentrated to 1·25–1.50 supersaturation according to purity, is seeded with a slurry of powdered sugar or fondant in *iso*-propyl alcohol, and the strike boiled on *A*-molasses. Data are tabulated, comparing different boiling systems and characterizing the improved sugar produced at three sugar factories.

* * *

Circulation in vacuum pans. E. HUGOT and G. H. JENKINS. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 232–241. Two equations are calculated (one using a simplifying approximation) for a function, the "rapidity ratio" in terms of the number of tubes in a calandria pan (n), their diameter (d) and the downtake diameter (D), and pan diameter (**A**). A variation of the simpler equation permits expression of the function in terms only of the variables n, d and D; this allows comparison only between pans of the same size since it is also assumed that the pan height is constant. The "rapidity ratio" is a measure of the evaporative capacity or speed of the pan, and thus its calculation for varying dimensions allows comparison of the results to be forecast. Examination of the effect of the various dimensions indicates that tube diameters should be larger than those used at present; the reduction in resistance to flow would more than compensate the reduced heating surface.

* * *

Modifications in continuous clarifiers used in the Williamson process. L. C. ROJAS. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 352–353.—In order to cure insufficient aeration, which had not been improved by varying the method of heating, the steam chest of the clarifier was eliminated, the inlets moved from the bottom to the upper part of the back of the trough, and discharge pipes arranged with perforations 3 ft from the inlet and 3 ft 6 in from the outlet (a zone in which the sampling experiments had shown well-clarified liquor to be present). A brilliant clarified liquor was obtained and flow through the clarifier could be increased by 50% without ill effects.

Beet storage. M. DRACHOVSKÁ, N. M. KICHIGIN, H. D. WALLENSTEIN and M. Z. KHELEMSKII. *Zeitsch. Zuckerind.*, 1960, **85,** 533–537.—Beet storage and the effects of mechanical harvesting and transporting on beet losses are discussed with reference to conditions in Czechoslovakia, East Germany and the Soviet Union.

* * *

Beet payment according to sugar content. A. S. GAL'PERIN. *Sakhar. Prom.*, 1960, (10), 49–53.—Replacement of the system of beet payment according to weight, at present practised in the U.S.S.R., by one based on sugar content is discussed. A suggested standard of 16% sugar content is recommended, and a suggested tarehouse scheme is described.

* * *

Carbonatation control. A. EMMERICH and A. MADI. *Zucker*, 1960, **13,** 554–560.—Tests have been carried out during three campaigns on carbonatation control at Gross-Gerau and Barum sugar factories, which employ the Braunschweig juice purification process[1]. Comparison between antimony and glass electrodes for pH control of carbonatation showed that the former gave a pH slope with an angle 50% greater than the actual. A drop of 0·2 units occurred periodically when the lime kilns were charged and the resultant air taken in by the juice influenced the potential of the antimony. The glass electrode gave readings constant to within ±0·2 units, but suffered from scale formation. Electrical conductivity was found to be a function neither of juice alkalinity nor of the pH values and, while control of 1st carbonatation by means of conductivity measurements would be better than manual control, the deviations from the optimum value are greater than with pH control.

* * *

Filtration of 1st carbonatation juice in the sugar factory. G. MALAGUZZI-VALERI. *Ind. Sacc. Ital.*, 1960, **53,** 181–194.—A series of parameters governing filtration are used to develop inter-relationships, expressed as formulae, which are then applied to the various types of filter used for 1st carbonatation juices. Methods of obtaining values for the parameters by means of graphs are described.

* * *

Filtration and filtrability. G. D'ORAZI. *Ind. Sacc. Ital.*, 1960, **53,** 195–200.—Equations are developed for the volume of liquid filtered as a function of time and filtrability coefficient. Criteria for achieving optimum filtration are discussed and the necessity of careful preliming is emphasized; this leads also to saving in lime as well as good juice filtrability.

Elmo gas pumps in sugar factories. W. BAUME. *Zeitsch. Zuckerind.*, 1960, **85,** 588–590.—The various applications of the Elmo gas pump are discussed[2].

* * *

Some remarks on the carbonate process. (1) S. VAJNA. *Zeitsch. Zuckerind.*, 1960, **85,** 598–599. (2) E. MOEBES. *ibid.*, 599–600.—(1) Points put forward by MOEBES[3] are answered. (2) The arguments of VAJNA[4] are countered.

* * *

Waste-water economy in Austrian sugar factories. K. SKALSKI. *Gaz. Cukr.*, 1960, **62,** 299–305.—A general picture is given of waste-water disposal and treatment at the seven Austrian sugar factories. Details are given of water analysis at five factories compared with that at six Polish factories.

* * *

Automatic control of boiler feed water. S. NIKIEL. *Gaz. Cukr.*, 1960, **62,** 305–307.—Of three schemes for automatic detection of sugar in boiler feed water using α-naphthol in H_2SO_4, $KMnO_4 + H_2SO_4$, and camphor in H_2SO_4[5], the last is considered the most reliable. Diagrams are presented of each scheme.

* * *

Rational dilution of 3rd product massecuite in mixers. K. WAGNEROWSKI. *Gaz. Cukr.*, 1960, **62,** 307–309.—A nomogram is presented showing the amount of water necessary to add to 3rd product massecuite in the crystallizer before curing, based on the expression $\Delta W = (Nc/A') - W$, where ΔW = amount of water to be added, Nc = non-sugars, A = non-sugars:water ratio of the massecuite and W = water in the intercrystalline molasses (100-Brix). Worked examples are given of calculations based on this equation.

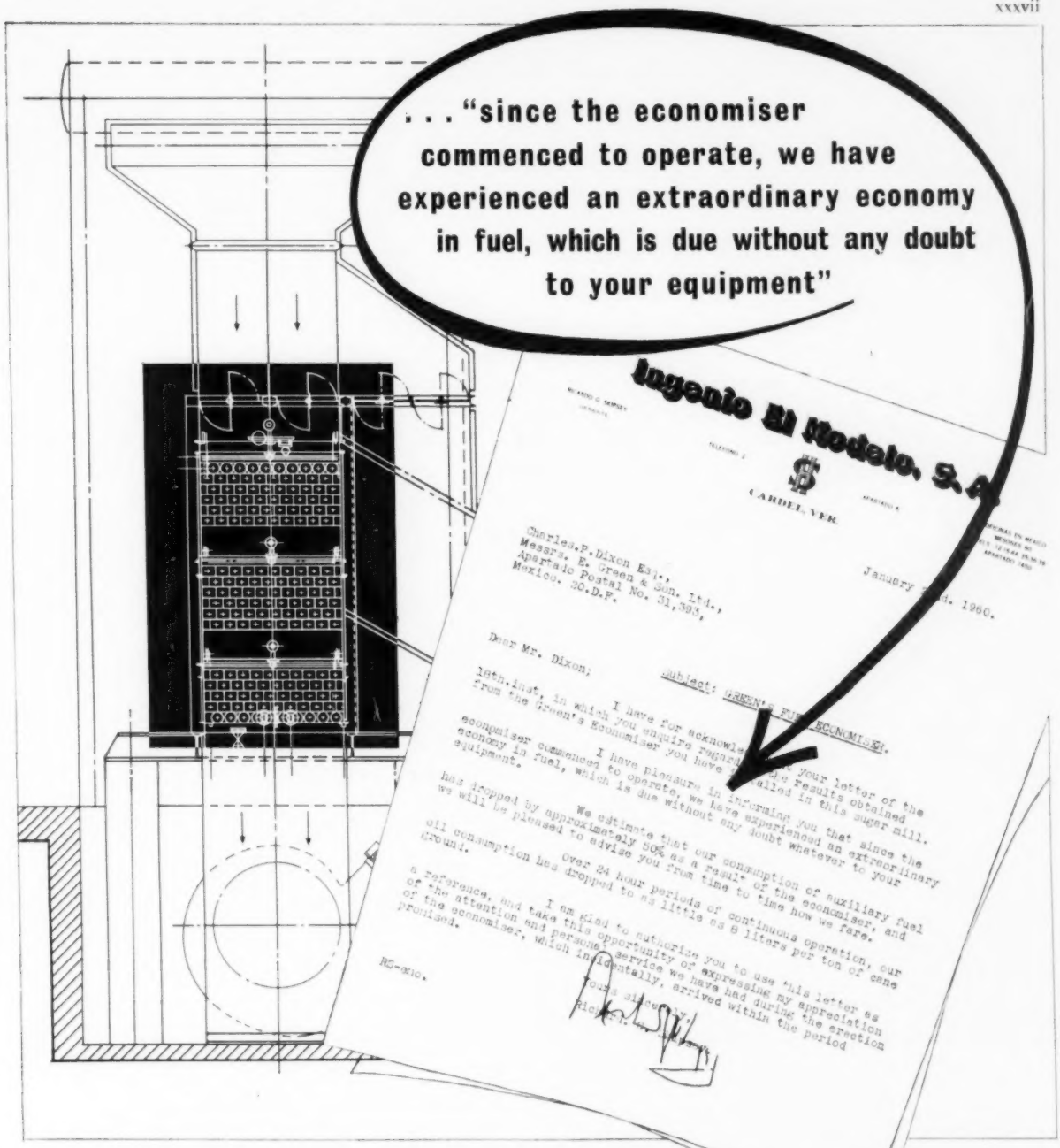
* * *

Sugar dryer. J. BUTEŃKO. *Gaz. Cukr.*, 1960, **62,** 309–310.—A sugar dryer designed for Soviet sugar factories is described with the aid of a diagram. It is capable of drying 24,400 kg of sugar per hour from 1·5% moisture content to 0·03% and cools it from 50°C to 25°C at an ambient of 13°C.

* * *

Prerequisites for complete automation of a sugar factory. M. CHRAZANOWSKA. *Gaz. Cukr.*, 1960, **62,** 330–333.—Automation of a sugar factory is con-

[1] *I.S.J.*, 1961, **63,** 10–14, 47–48.
[2] *See I.S.J.*, 1959, **61,** 278.
[3] *I.S.J.*, 1961, **63,** 52.
[4] *Cf. I.S.J.*, 1960, **62,** 354.
[5] *See* HADI: *I.S.J.*, 1959, **61,** 252.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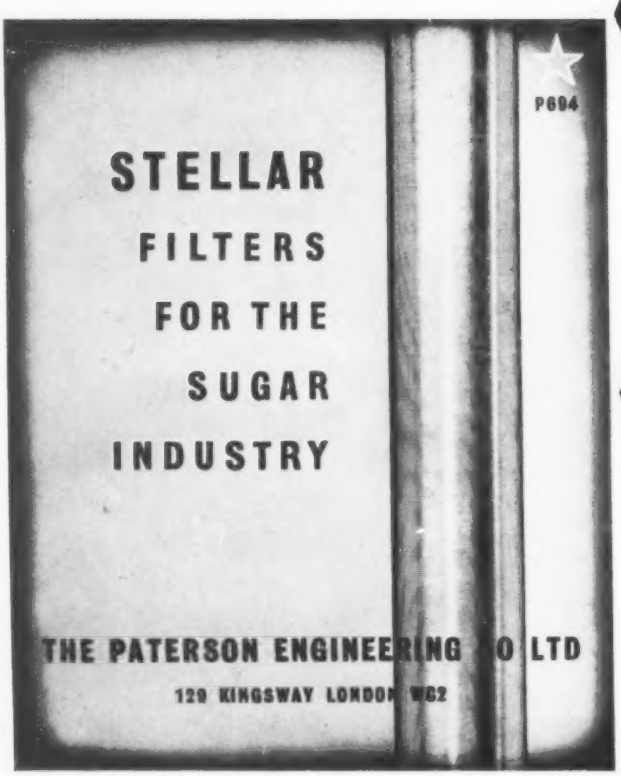

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* * *

Heat insulation. W. FORNALEK. *Gaz. Cukr.*, 1960, **62,** 334–338.—The subject is dealt with mathematically, with tables presented of the heat conductivity of various materials. It is shown that at 0·295 in Hg with a 300 mm dia. tube at 300°C, a loss of 5950 kcal/hr may be sustained without adequate insulation, while this loss can be reduced to 208 kcal/hr with 140 mm of insulation.

* * *

Report on beet sugar manufacture. Y. T. CHUNG and I. H. CHEN. *Taiwan Sugar*, 1960, **7,** (8), 19–23.—Pilot-scale experiments (15 tons of beet per day) on beet sugar production are discussed. Data are presented for 33 days' processing. It was found that the quality could be raised to the SWC standard and that the manufacturing costs, based on a sugar yield of 9·22% on beet, are "not too high" compared with cane sugar, considering the cost of bagasse used as fuel for cane and of coal used for beet. The economics of beet sugar production depend on the cost of the raw material and the price of sugar on the world market.

* * *

Steam pressures and power production in the sugar industry. G. STRAUSS. *Zuckererzeugung*, 1960, **4,** 307–309.—Heat calculations are presented based on the steam pressure required for a given power output in kW. The economics are also discussed. It is concluded that on the basis of costs per ton of steam and per kWh, the economics of a steam power plant depend on local conditions and do not affect the initial costs so much as may be assumed. Conversion to a pressure of 52 atm or more in high pressure boilers is shown by examples to be necessary as are evaporators with large vapour spaces, in order to avoid the use of a desuperheater.

* * *

Foam destruction by compression waves. R PARLOW. *Zucker*, 1960, **13,** 582–584.—A device is described[1] which incorporates a number of annular plates connected to a magnetostriction oscillator and a disc covering the plates and fitted with conical members. The annular plates are arranged above the foam surface, the bottom one being sufficiently near so that at 6000 vibrations per min the foam will be forced up into the disc and will then be discharged in the form of a spray, thus helping to break up the foam.

* * *

Theory of the closed circuit (of water) in sugar manufacture. Forecast of the time and state of equilibrium. F. EDELINE. *Bull. Trimestriel du Centre Belge d'Etude et de Documentation des Eaux*, 1960, (47), 61–64; through *S.I.A.*, 1960, **22,** Abs. 972.—Beet transport is favoured by the use of a liquid of high density, so that the flume water can be recirculated after simple mud separation by decantation. Beet wash water tends to become charged with organic matter and purification is needed as well as decantation, in order to produce clean water. Water circuits in parallel, where the transport water can be taken to the decanter when necessary, and the wash water switched to transport, are the most efficient solution. Equations are developed showing the relations between the volume of water in circulation, the volume of wash water used, the amount discharged for purification, the amount of sugar liberated into the wash water per hour, and the amount of mud recovered in the decanters. The concentration of sugar in solution at equilibrium in a closed circuit can then be calculated, and the time to reach equilibrium can also be derived. Two practical examples are worked out.

* * *

Introduction of the first apparatus for continuous progressive pre-liming in Polish sugar factories. A. ŻELAZNY, I. KARCZEWSKA-OGLAZA and S. GAWRYCH. *Prace Inst. Lab. Badawczych Przemyslu Spozywczego*, 1960, **10,** 41–55; through *S.I.A.*, 1960, **22,** Abs. 1038.—Two installations are described in detail. At Sokolów factory a U-shaped trough of length 7 m and radius 1 m is divided into seven compartments, with a revolving stirrer along its axis. Juice overflows from each compartment to the next at a height of 1·46 m and is conducted nearly to the bottom of the next compartment by a rectangular tube. Unfiltered first saturation juice is used as the liming fluid, and passes along seven tubes of 35 mm diameter entering the trough through the rectangular tubes and discharging at their base. The installation at Witaszyce factory has two troughs side by side divided into a total of eight compartments, with other minor differences. The working is discussed with graphs and tables. Filtration rates were improved by 30%, with an optimum pH of pre-limed juice between 10·5 and 11. A mechanical fault in the former apparatus is created by the stirrer which breaks the surface of the liquid and causes foaming.

* * *

Juice purification in sugar factories by a system introduced into the U.S.S.R. from Poland. S. ZAGRODZKI. *Sakhar. Prom.*, 1960, (11), 15–18.—The juice is progressively pre-limed to just above pH 11, and then subjected to a three-stage defeco-saturation, in which a portion of lime (of a total of 1·2–2·25% CaO on weight of beet) is added at each of three carbonatation vessels. Up to 100% juice from the first vessel is returned to predefecation. After double filtration, the juice (at almost pH 11) goes to second carbonatation, the muds being passed via hydrocyclones to pre-liming. The advantages of the scheme are enumerated, including the treatment of poor beet and great flexibility of the system. Its defects include a first carbonatation alkalinity of only 0·08% CaO, which results in lower juice purity, higher colour and lime salts content.

[1] German Patent 972,899.

Investigations with the wet disintegrator for the direct analysis of cane. R. DEICKE. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 168–174.—Investigation of the use and modification of the Sugar Research Institute wet disintegrator is described. The original unit comprises a shaft carrying three 5-inch spring steel blades and rotating at 6000 r.p.m. inside a 13 in high × 11 in dia. cylinder. Extraction is complete after 45 min. This was reduced to 15–20 min by fitting two shafts carrying 5 in blades; however, this was mechanically unsuitable for routine application. Use of 6 in or 7 in blades lowered the time needed for complete extraction to 30 and 15 min respectively, and the use of 7-inch blades during 30 minutes was adopted, together with baffles in the inner wall to direct hard nodal tissue into the cutting zone, and water-jacketing to restrict the temperature to 40°C.

* * *

Direct analysis of cane using a wet disintegrator. S. R. HARRIS, P. A. HANKS *et al. Proc. 10th Congr. I.S.S.C.T.*, 1959, 188–199.—A number of factors affecting cane analysis by the wet disintegrator method have been examined. These include: the preservation of shredded cane samples prior to analysis, loss of water during the initial hammer-mill treatment, completeness of Brix and pol extraction during the disintegation, water and fibre in cane determination, Brix determination in disintegrator liquor, the effect of hygroscopic water on cane analysis, and the accuracy and reproducibility of the analytical methods, sampling and cane analysis. The method favoured consists of wet disintegrating 1 part of hammer-milled cane with 3 parts of water for 45 min using 3 blades of 6-inch overall length, 1½ in width and 1/32 in thick, on the bottom of a 1 in shaft rotating at 5700 r.p.m. in a 4 gal can. The resulting slurry is strained through a 120 mesh screen, cooled to 25°C or below, filtered using "Supercel" filter-aid, and the filtrate analysed for Brix (using a Geissler pycnometer) and pol (using a 400 mm tube). Water and fibre determination in hammer-milled cane is carried out using a Spencer-type oven and the cane analysis calculated from the water or fibre figure, applying a correction factor of 0·992 (equivalent to 25% water adsorption on dry fibre) for hygroscopic water.

* * *

Application of the pol ratio method of cane analysis. J. G. DARROCH, F. C. DENISON and L. J. RHODES. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 199–205.—The pol ratio method of cane quality evaluation, introduced by PAYNE & MAHON[1], is described, together with an account of its application in sampling field measurements and measurements of areas, scheduling fields for harvest, field distribution and planters' cane, and estimating sugar losses.

* * *

Insoluble solids in cane juice. B. CORTIS-JONES. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 221–227.—The fine insoluble matter in clarified juice has been shown to have the same composition (apart from slightly higher N content) as that in raw juice. It is thus carried through during clarification and is not incompletely-precipitated reaction product. The insolubles were separated into 6 fractions, four heavier than juice and two lighter, using a system of differential centrifugation at 2250 *g*, 25,000 *g*, 50,000 *g* and 140,000 *g*. The relative proportions of each fraction were measured and in one case the total weight was 64 mg/100 ml. The fractions were re-dispersed in insoluble-free juice and their flocculation studied under various conditions; definite flocculation occurred by the action of Ca^{++} and heat alone. Under certain conditions complete flocculation of all fractions seems to be possible, although corresponding fractions from different juices behave differently under some circumstances.

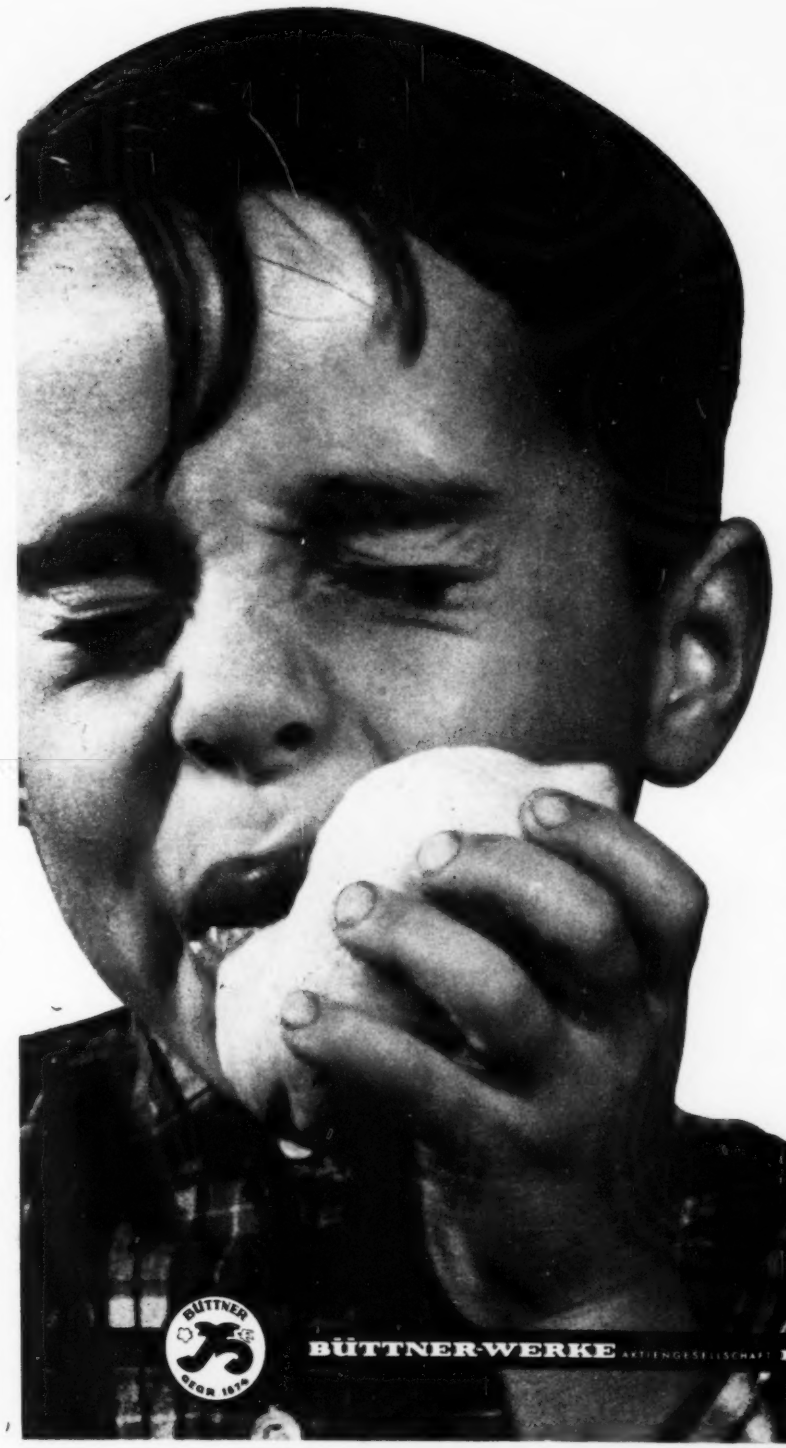
* * *

Sucrose crystal growth. H. E. C. POWERS. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 242–248.—Evidence of the differential rates of growth of sucrose crystal surfaces is presented by argument and photograph. Results of such differential growth, e.g. inclusions, internal strains, etc. are discussed, together with laboratory techniques for crystal growth studies.

* * *

Crystallization velocity of sucrose at higher temperatures. P. V. GOLOVIN and A. A. GERASIMENKO. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 248–262.—Details are given of a technique whereby perfect crystals are grown under very carefully controlled conditions and after weighing are maintained at constant temperature in solutions of various concentrations and purities.[2] The rates of growth are measured by determining the increase in weight as a function of the deflection of the balanced quartz thread from which the crystal was suspended. Growth data at 70, 80 and 90°C are recorded and shown in graph form. An unexpected result is that crystallization velocity in pure sucrose solution at 80° and 90°C was not lower than at 70°C. In pure sucrose solution and a syrup of 93·08 purity, the crystallization velocity was in linear proportion to the excess supersaturation (supersaturation–1); with a low purity (79·28) syrup, the proportion was not linear and it was found that the growth rate

[1] *Proc. 9th Congr. I.S.S.C.T.*, 1956; *I.S.J.*, 1957, **59**, 105.
[2] *See also I.S.J.*, 1959, **61**, 284.



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increased with a temperature rise from 70 to 80°C but fell again at 90°C. Arguments are presented against the practice of boiling to 96% solids followed by dilution to 92% in the crystallizer; it is considered better to boil only to 92% solids, cool to 5–10°C below spinning temperature and then to reheat before spinning.

* * *

Improved saturation cell and a laboratory vacuum pan for research work. G. RUSH and C. MEREDYTH. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 263–269.—A description is given of the HARMAN saturation cell[1] as developed during the past 25 years. Modifications include automatic control of the rate of temperature rise; use of a "Perspex" (polymethylmethacrylate) cover slip in place of glass to reduce heat transfer from syrup to atmosphere—this heat loss is also compensated by use of standardized apparatus, conditions and a correction scale. The laboratory vacuum pan, also originating in the early 1930's and developed since, is described and illustrated. The body is a soda-glass cylinder of 6 in dia. with a hemispherical bottom. It has a $\frac{3}{8}$-in brass head plate through which pass the pan fittings, including the vacuum line, steam coils, stirrer shaft, and a circulation baffle. A thermostatically-controlled water jacket may be fitted, and inlets for sugar seed, syrup and water. Instrumentation includes measurement of b.p. elevation and massecuite conductivity. The pan can be used for high and low-grade boilings and details are given of the techniques used.

* * *

Relationship between the conditions of crystallization structure and shape of crystals. N. N. SHEFTAL and I. V. GAVRILOVA. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 282–286.—Laboratory experiments on the growth of crystals under strictly controlled conditions of initial supersaturation and temperature, the latter decreasing very slowly ($\frac{1}{2}$°C over 13–14 days), are discussed. Inclusions formed with stationary crystals can be avoided by rotating them with at least two changes of direction per minute. (This creates turbulence in the liquor which removes local pockets of heterogeneous supersaturation.) Temperature of crystallization affects growth along the *c*-axis, producing narrower, long crystals at lower temperatures and more isometric crystals at higher temperatures. This makes it more difficult to obtain perfect simple crystals at higher temperatures, and to obtain uniformity among the crystals. Surface effects of the medium are discussed with particular reference to dye absorption on individual surfaces of growing potash alum crystals.

* * *

A calorimetric method for the determination of the relative rate of crystallization of sucrose in the presence of additives. D. NAPPER and A. E. ALEXANDER. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 286–291.—A sucrose solution is prepared and the crystallization rate measured calorimetrically using a HUTCHINSON & WHITE microcalorimeter[2], comprising a tightly-corked 500 c.c. Dewar flask maintained at 25·00±0·02°C, having a glass stirrer, seed input tube and a glass thermistor support. The 500-ohm thermistor—a thermally sensitive resistor—was used as one arm of a Wheatstone bridge circuit and its resistance changes measured with a sensitivity of 0·1 ohm. Results were reproducible to 3–5%. The pattern of the resistance changes is discussed as is the effect of certain additives including colloidal electrolytes (cetyl trimethyl ammonium bromide, sodium cetyl sulphate, etc.), polymeric compounds (gelatin, polymethacrylic acid, etc.) and electrolytes (KCl + $CaCl_2$). The last affected crystallization rate as anticipated from their effect on sucrose solubility, while a similar effect was probably the cause of the slight decrease found in the case of the colloidal electrolytes (maximum 8% *vs.* 5% experimental error). No effect was found with the second group of additives.

* * *

The non-sucrose constituents of Hawaiian raw cane sugar crystals. C. C. TU and K. ONNA. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 291–304.—Methanol crystallization of raw sugar and treatment with ether, acetone, and ethanol permitted the separation of non-sucrose constituents into seven groups: naturally occuring plant pigments, thermally degraded carbohydrate products, alkali-degraded carbohydrate products, molecular inter-action of amino acids and the degraded carbohydrate products (melanoidins), simple sugars and oligosaccharides, amino acids and inorganic compounds. Application of paper chromatography and paper electrophoresis, among other techniques, has enabled most of the impurities to be identified tentatively.

* * *

Rate of growth of sucrose crystals at very low supersaturation. A. VANHOOK and W. A. VANHOOK. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 305–309.—Small well-formed crystals were permanently mounted and allowed to grow in a gently-stirred large excess of syrups of low supersaturation, the changes in their dimensions being measured with a travelling microscope. Supersaturation was varied by successive slight increases in temperature and also by injections of small amounts of water. In the first case, temperature control was to within 0·05°C (except for one momentary drop) and the results indicate a linear relation between growth rate and supersaturation over the range 1·001–1·015 supersaturation. When water was added to change the supersaturation, similar results were found, the growth rate being linear and finite at supersaturations as low as 1·006. Application to the WISE technique[3] of estimating sucrose solubility from velocity data to growth rates observed by the authors gives figures which are compared with those of HERZFELD and reasons advanced for divergences.

[1] *Proc. 4th Congr. I.S.S.C.T.*, 1932, *Bull.* (98), 129–131.
[2] *J. Sci. Inst.*, 1955, **32**, 309.
[3] *I.S.J.*, 1954, **56**, 69; *J. Chem. Soc.*, 1955, 2714.

Factors influencing the growth of sucrose crystals. N. ALBON and W. J. DUNNING. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 310–315.—The development of growth on a (100) surface of a sugar crystal is a well established phenomenon and it arises where spiral growth occurs at a screw dislocation. The height of the step is multimolecular, e.g. 1700 A, and is affected by the presence and concentration of dextrose or levulose, degree of supersaturation, and temperature. The nature of these relationships and the influence of supersaturation and temperature on the growth rates in the [010] and [010] directions have been studied, results being tabulated and presented in graph form.

* * *

Weighing techniques to determine the effect of some inorganic and organic compounds on the rate of sucrose crystallization. T. MORITSUGU. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 315–323.—Crystals of 100–200 mg weight were allowed to grow freely suspended in a syrup in a 500 ml flask maintained at either 30·6° or 40·3°C. After 17 hr they were removed, wiped, washed with *iso*-propanol and weighed to give the rate of growth (u) as calculated from KUCHARENKO's formula $u = \frac{10{,}000}{st} \Delta p$ mg/sq.m./min, where t=time in min, s=crystal surface (=4·12 $\sqrt[3]{p^2}$ sq.cm.) and Δp=increase in weight (mg) with p=average crystal weight (g). Measurements show that, in general, monovalant cations decrease the crystallization rate of sucrose under the conditions studied, while polyvalent cations increase the rate. With mixtures, the effects appear to become unpredictable. Chlorides and carbonates appear to slow down crystallization whereas sulphates increase the rate. Amino acids and aconitic acids decrease the rate while glucose slightly increases it.

* * *

Measurements of crystallization rates of sucrose from pure and impure solutions. B. M. SMYTHE. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 323–336.—A method is described for measuring sucrose crystallization rate with satisfactory accuracy. A single crystal is suspended from a torsion balance in a stirred solution and the change in weight with time is noted. The rate of crystallization increases with flow rate up to reasonably high velocities, the rate being appreciably higher than most previously reported and its relationship with supersaturation being more nearly linear. At low supersaturation, however, this relationship becomes of a higher order than first and deviates from linearity, as is to be expected from the dislocation theory of crystal growth. It is suggested that of the two rate-controlling steps in sucrose crystallization, the importance of diffusion relative to dissociation of hydrated sucrose molecules increases with increasing temperature. Experiments were carried out with impure solutions (*B*-molasses) and these indicate that certain impurities, including complex polysaccharides, affect one or other of the above steps, so having a differential effect on crystallization rate depending on their relative importance, i.e. at different supersaturations. Other effects may be caused by hindrance of the diffusion process, alteration of the extent of sucrose hydration, or adsorption on the crystal surface, all of which could affect crystallization rates.

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Granulometric analysis of massecuites. J. DEDEK. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 337–339.—A brief account is given of the technique developed in the author's laboratory[1].

* * *

Measurement of crystallization velocity in cane molasses. D. H. FOSTER. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 339–346.—Experiments are described in which refined sugar and C-sugar crystals were held at controlled temperatures in tubes of molasses which had been centrifuged and of which the supersaturation had been measured accurately. The dimensions of the crystals before and after growth were measured with a precision of 0·001 mm using a photo-micrographic technique, and the growth rates calculated from the results. These are related to the chemical properties of the molasses, highest rates being found with molasses originating from Q 50 cane and having higher contents of MgO, Cl^- and SO_4 . Cooling of massecuites has provided data on growth rate dependence on purity and has shown that appreciable crystallization continues even at very low purities, molasses viscosity being the only real factor controlling factory exhaustion. A graph is presented illustrating the change of the growth rate in a particular molasses with supersaturation at various temperatures (30, 40 and 50°C).

* * *

Organic acid composition of some commercial cane varieties grown in Mauritius. D. H. PARISH. *Proc. 10th Congr. I.S.S.C.T.*, 1959. 347–351.—Shredded cane samples from experimental plots yielded juices which were filtered through cottonwool and analysed chromatographically for amino acids and non-nitrogenous organic acids. The results were related to the treatment given to the experimental plots. Nitrogen fertilization increased amino acids markedly, while rainfall and/or crop response to nitrogen may also be important, and varietal characteristics are of slight effect. Non-nitrogenous organic acids were not affected by these factors. Except in abnormal cases, e.g. of drought, the rôle of amino acids is not critical as their concentration varies much more widely than known factory performances.

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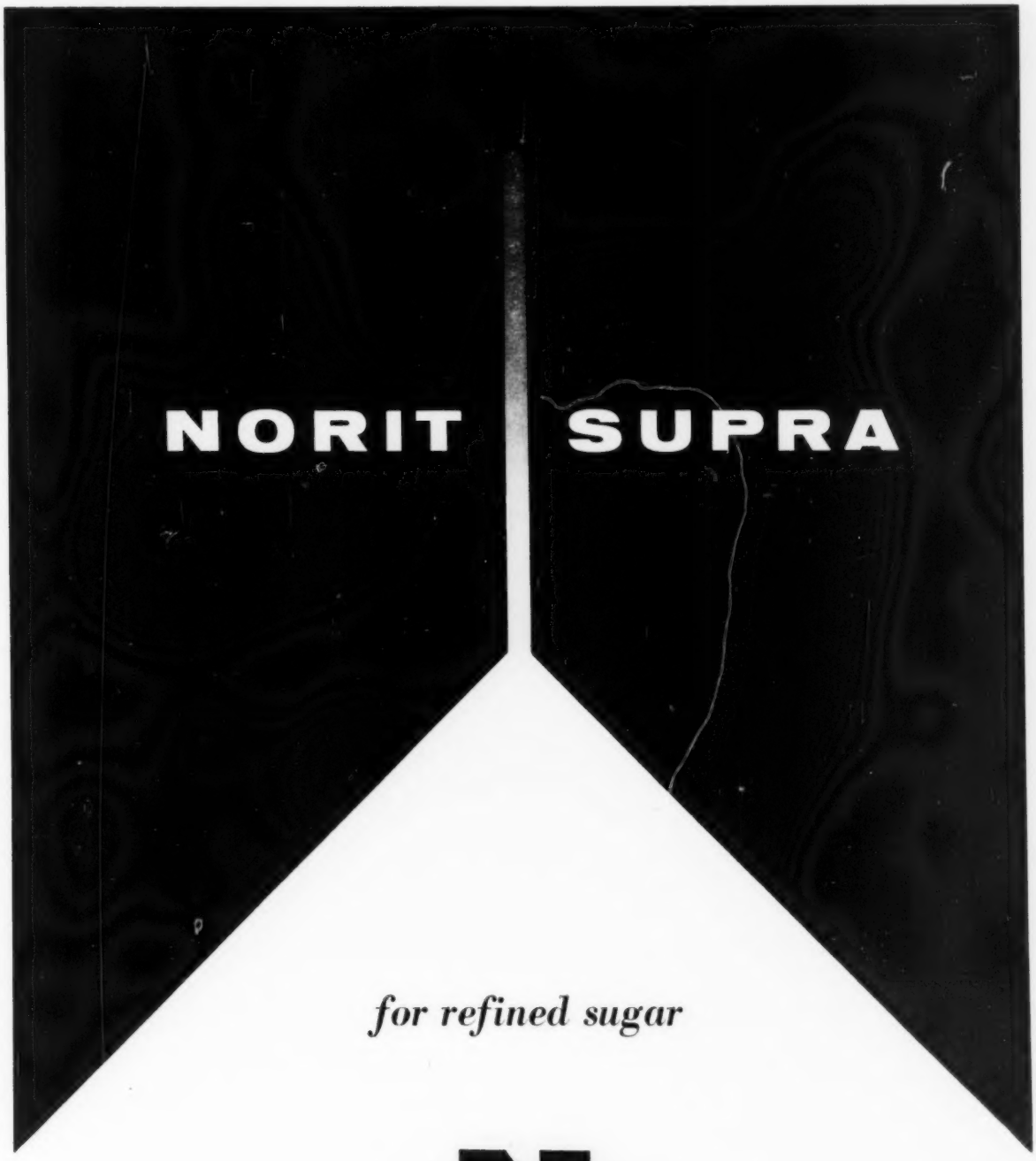
Presence of phosphates in cane juices. P. HONIG. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 356–361.—The subject is reviewed with six references to the literature. Aspects covered include: analytical determination of phosphate in juices, different forms of juice phosphate, phosphate in cane stalks, juice and bagasse, distribution between expressed juice and cane stalks, distribution over the length of mature cane stalks, the level of organic phosphate in cane and juice, the significance of juice phosphate to the field department, the continuous recording of *ortho*-phosphate in juice and the importance of both *ortho*- and organic phosphate as a measure of the cane physiological status.

[1] *I.S.J.*, 1958, **60**, 338; 1959, **61**, 58.



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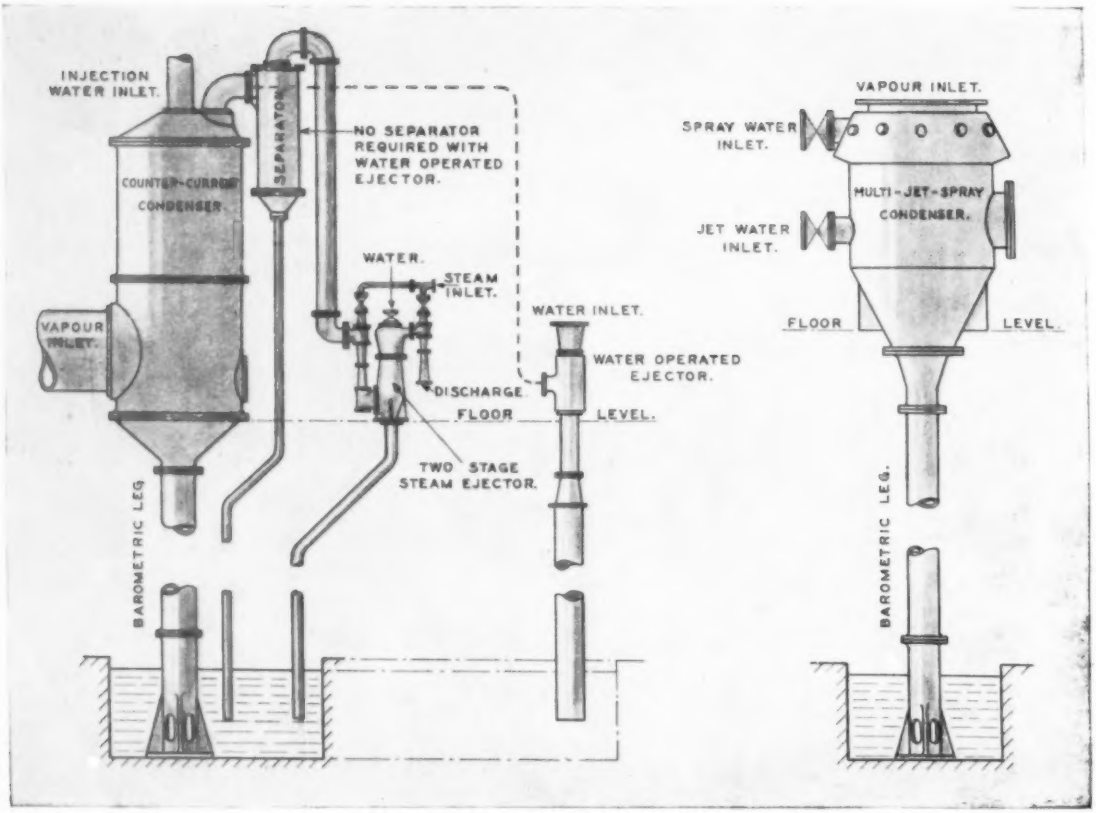

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Bagasse: essential raw material of development. R. C. BOURBAKIS. *Cubazúcar*, 1960, **5**, (3, 4, 5), 12–14. The amount of oil fuel needed to replace the bagasse used as fuel in Cuban sugar factory furnaces is calculated, and the possibility discussed of establishing a plant in the Cienfuegos area for manufacture of paper and board products, a market being envisaged in the Caribbean area.

* * *

Ammoniation of defibrated cane. J. R. DE LA VEGA and C. PADIAL. *Mem. XXXII Conf. Asoc. Técn. Azuc. Cuba*, 1958, 277–291.—In an examination of the ammoniation of defibrated cane it was discovered that both anhydrous ammonia and ammonia solution could be used, but the former was preferable because the solution extracted sugar which was lost from the product. Using anhydrous ammonia, nitrogen was absorbed to the extent of 0·725–3·7% on solids, depending on the type of cane, its composition, moisture content, and ammoniation temperature and duration. Approximately half of the N is soluble in water. Half an hour appears sufficient for the reaction to be completed, while in contrast to the results of other workers, nitrogen absorption did not increase appreciably with higher temperature. More nitrogen was absorbed when the cane contained less moisture, while it was found that the percentage of pentosans in the bagasse did not affect the extent of absorption. Little increase in N absorption was achieved by increasing the pressure from 125 to 300 p.s.i. Chlorination of cane before ammoniation increased the N content from 1·14% to 5·58%; absorption is believed to be at carboxylic acid residues formed at terminal carbon atoms by oxidation.

* * *

The current status of sucrochemistry. H. B. HASS. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 31–37.—An account is given of the history of sugar cane and beet by-products utilization and research, with a survey of current projects under the aegis of the Sugar Research Foundation.

* * *

What of sucrochemistry ? P. WAHL. *Sucr. Belge*, 1960, **80**, 97–104.—A brief reappraisal of sucrochemistry with mention of the industrial usages of sugar, sugar by-products, and of various reactions and reaction products. A short bibliography is appended.

* * *

Fermentation of sugar cane molasses in Brazil. W. DREWS. *Brasil Açuc.*, 1960, **15**, (2), 6–26.—The fermentation of molasses to alcohol depends on four factors: the molasses, the industrial equipment of the distillery, the water and yeast, and antiseptics and nutrients. All are considered separately. Differences between beet and cane molasses are tabulated and OWEN quoted concerning the loss of fermentable sugars on storage of cane molasses. Molasses used in Brazil is generally of 83–85°Bx, 32–35 purity, contains 14–20% invert and is of pH 6·8 or occasionally 7·0. A factor which caused difficulty after the 1959/60 crop was the fact that the sulphur used was not pure and quantities of selenium passed into the molasses, causing dysentery in the animals fed with molasses as fodder. Occasionally Brazilian molasses has a peculiar odour, caused by volatile acids, which is associated with difficulty in fermentation. Types of inadequacies in distillery plant are discussed, with their effects. Shortage of water, particularly where sugar factory capacity has outgrown available water supplies, has meant re-use of waste waters, and in some cases closure of distilleries. Reference is made to the danger of infection where return water is used. In Brazil, *Aspergillus* and *Mucor* yeasts used are almost exclusively "Standard Brand", although the Rio de Janeiro Institute of Technology has developed a successful strain, designated "M". Also, at Usina Ester, in Sao Paulo, a strain imported from the Fermentation Institute in Berlin has been used for 25 years. The apparently inevitable infection of the yeast strain leads to poor results and it is necessary to start using new yeast after a little while. The use of a prefermentation tank, where pure yeast can be developed for inoculation of the main fermentation, is recommended. The antiseptics used in Brazil in the past and currently are surveyed, and the use of superphosphate and ammonium sulphate as nutrients discussed. Details are given of the techniques adopted for fermentation with and without the use of pentachlorophenol.

* * *

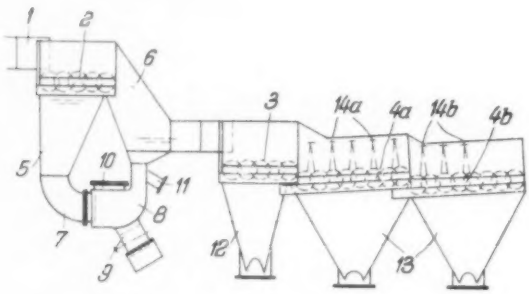
Study on pig feeding. I. Sorghum and molasses. E. LORENZO LUACES and K. COX. *Bol. Ofic. A.T.A.C.*, 1960, **19**, 283–286.—An experiment on feeding has shown that sorghum and molasses can be given to pigs as well as can maize and molasses.

* * *

Fermentation of cane juice. J. ROCHA DE ALMEIDA. *Brasil Açuc.*, 1960, **55**, (3), 5.—Details are given of a process for alcoholic fermentation of cane juice. This is screened to remove bagacillo and adjusted to 12–14°Bx for the first 10 days of operation, 14–16°Bx for the second 10 days and 16–18°Bx for the third 10 days, thereafter reverting to 12–14°Bx and so on (this system avoids harmful effects in the fermentation and yields pure alcohol). The temperature is adjusted to 24–26°C so that it does not go above 35°C during the fermentation. To maintain the correct pH, 25, 50 and 75 ml of sulphuric acid per 100 litres are added during the 1st, 2nd and 3rd 10 day periods, while nutrients, etc., also added are, per 100 litres, 100 g ammonium sulphate, 1 g cobalt sulphate, 1 g manganese sulphite, 5 g magnesium sulphate and 100 g of rice starch. In addition, to maintain must purity, 3 ml of "Emulsan A1" is added per 100 litres. Three systems of fermentation are described: re-utilization of yeast footing, individual footings, and the Melle-Boinot-Almeida process.

UNITED KINGDOM

Process and apparatus for the cleansing of sugar beet. ELFA-APPARATE-VERTRIEBS G.m.b.H., of Mülheim/Ruhr, Germany. **855,605.** 8th January 1959; 7th December 1960.—Beet to be cleaned pass from flume 1 to the roller grid 2. Flume water and fine particles such as sand, etc., pass through the grid



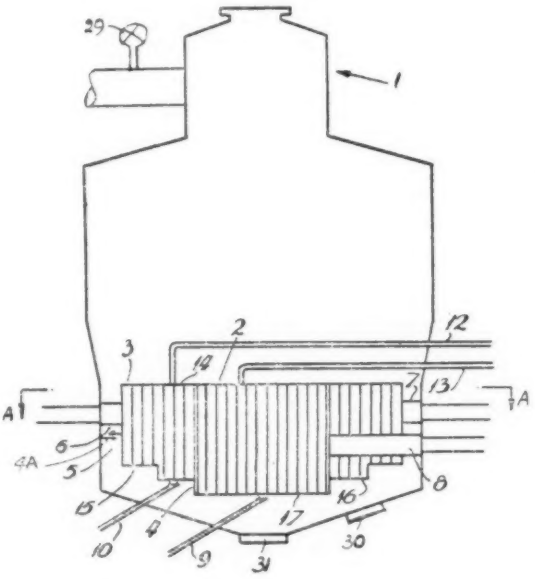
into chamber 5, and so to pipe bend 7, while coarser materials are carried with the beet into chamber 6. Here the heavier materials—stones, etc.—fall to the bottom pipe bend 8, while the beet, carried by the overflowing water, supplied with compressed air or water through entry socket 11, pass on to the roller grid 3. The pipe bends 7 and 8 are connected and are provided with an outlet 9 for periodic discharge of the sand and stones, etc. The overflow water and accompanying dirt are separated from the beets on roller grid 3 and fall into discharge funnel 12, while the beet pass to roller grids 4a and 4b. These are inclined to ensure slow passage of the beets, and also have sprays 14a, 14b mounted above. The beets are sprayed with clean water through 14a and may be sprayed with water containing disinfectant through 14b, in which case the discharge funnels 13 are separate.

* * *

Production of sucrose esters. DISTILLERS CO. LTD., of Edinburgh 3, Scotland. **859,305.** 25th May 1959; 18th January 1961.—Sucrose and an alkyl ester of an aliphatic monocarboxylic acid (1–20 C atoms/mol) are reacted in the presence of an alkaline alcoholysis catalyst (alkali metal carbonate or alkoxide), a reaction solvent (dimethylformamide or sulphoxide) and a hydrocarbon (aliphatic or *cyclo*-aliphatic, benzene) as entrainer, distilling off the alkyl alcohol formed as the reaction proceeds as an azeotrope (of b.p. $<100°C$) with the entrainer, the volume of azeotrope indicating the progress of the reaction since sufficient entrainer is present to form an azeotrope with all the alcohol formed. The reaction mixture may be dried by azeotropic distillation before adding the catalyst.

* * *

Calandria vacuum pan. A. P. SARANIN and C. J. ALLAN, of Bundaberg, Queensland, Australia. **863,710**; 24th August 1959; 8th February 1961.—The vacuum pan 1 is provided with the usual vacuum pump 29, syrup feed inlet 30 and massecuite discharge valve 31, but its calandria, designed to improve circulation without impairing heat transfer, is in two parts 2, 3, the inner part 2 preferably being supplied (through pipe 8) with steam at a higher pressure than that supplied (through pipes 6, 7) to the outer part 3. The design illustrated is in the form of a floating duplex calandria, supported by brackets 4a. The two



parts of the calandria are separated by a partitioning wall 4 but have a common upper tube plate 14. Condensates are removed through pipes 9, 10 and incondensible gases through pipes 12, 13. The inner part 2 is fitted with a bottom tube plate 17 while that of outer part 3 is in the form of a stepped annulus 15, 16. Syrup and massecuite passing through the tubes circulate through the annular space 5 between the outer calandria 3 and the pan wall.

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 3s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

In another form, the bottom tube plate of the outer calandria is frustro-conical and forms a smooth downwardly-sloping surface, while the calandria tubes are progressively shorter from partition 4 towards the pan wall. In another form, the inner and outer calandria parts are annular, with common upper and lower tube sheets, part 2 having a central downtake.

* * *

Beet thinners. Ets. SAVARY-SEBILLE & CIE. S.A.R.L., of Estrees, Nord, France. **861,590**; **861,591**. 3rd July 1959; 22nd February 1961.

* * *

UNITED STATES

Beet diffuser. W. KAETHER, assr. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **2,954,790.** 24th February 1958; 4th October 1960.—See U.K.P. 822,223[1].

* * *

Pulping process. D. B. SPARROW, assr. ARTHUR D. LITTLE INC., of Cambridge, Mass., U.S.A. **2,958,122.** 14th July 1958; 1st November 1960.—Cellulosic material (bagasse) is reduced to small particles all of which is between 0·04 and 2·0 mm in the dimension perpendicular to the fibre direction. These particles are contacted with 10 parts by weight of a solution of an oxidising-bleaching agent selected from the alkaline hypochlorites, sodium peroxide and chlorine dioxide, thereby rapidly and uniformly to soften them without any substantial destruction and removal of the lignin. The contact lasts for 10 min–3 hr at room temperature and atmospheric pressure, after which the softened particles are subjected to an antichlor treatment and mechanically disintegrated in a moist condition to produce fibres.

* * *

Treatment of beet clusters (rubbing) preparatory to sowing. F. HARMOS, P. FÖRSTNER, G. CSAPODY, M. DEUTSCH and L. LUKÁCS, assrs. AGRIMPEX MEZÖGAZDASÁGI KULKERESKEDELMI VALLÁLAT, of Budapest, Hungary. **2,959,893.**

* * *

Filter. H. JUNG, of Siegen, Westf., Germany. **2,963,158.** 11th September 1956; 6th December 1960. Cf. U.K.P. 841,573[2].

* * *

Filter (leaf) construction. E. L. OLIVER and D. RICHARDS, assrs. DORR-OLIVER INC., of Stamford, Conn., U.S.A. **2,964,194.** 17th April 1957; 13th December 1960.—Leaves for a rotary vacuum filter are constructed in the form of segments of an annulus, each segment having a frame with two radial and one peripheral members attached to an inner member having an outlet port for filtrate. The frame is supplied with a normal filter medium which is supported, however, by a grid structure which is in two sections, back to back, to allow for filtration through both sides of the leaf. The two sections present a large proportion of free space for passage of filtrate, a channel to the exit port being formed between the sections which are held apart from each other by a series of spacer studs. A continuous plate may also be located between the sections to eliminate blowback difficulties.

* * *

Method of purifying sugar juices. J. J. F. DELFOT, assr. N. V. ALGEMEENE NORIT MIJ., of Amsterdam, Holland. **2,964,428.** 9th May 1956; 13th December 1960.—Cane sugar solutions are purified by adding lime and phosphoric acid, introducing air, and separating the calcium phosphate scum containing occluded air bubbles from the clarified solution, stirring the latter with activated carbon to remove colouring matter, separating the carbon by filtration from the decolorized solution, and returning it to the sugar solution before lime and phosphoric acid treatment.

* * *

Bagasse baler automatic bale trip mechanism. H. S. TOUPS, L. P. BRAUD and R. H. BRAUD, assrs. THIBODAUX BOILER WORKS INC., of Thibodaux, La., U.S.A. **2,969,013.** 2nd May 1958; 24th January 1961.

* * *

Purification of beet sugar solutions. (*A*) W. M. GROSVENOR, assr. THE AMERICAN SUGAR REFINING CO., of New York, N.Y., U.S.A. **2,969,297.** 22nd June 1959; 24th January 1961. (*B*) R. A. MCGINNIS, assr. SPRECKELS SUGAR CO., of San Francisco, Calif., U.S.A. **2,969,298.** 22nd June 1959; 24th January, 1961.

(*A*) Beet juices are treated continuously to remove floc-forming materials by passing them upwards through a long vertical column in counter-current to a downwardly-flowing bed of granular floc-forming-material-adsorbent carbon, continuously supplying the hot sugar solution to the bottom of the column, distributing it evenly over the cross-sectional area. The solution flows upwards as a linearly ascending column of sugar liquor through the downwardly flowing bed at a rate sufficient to maintain the bed of adsorbent carbon in an expanded state as a substantially linearly descending column. A body of purified sugar solution is maintained above the adsorbent and solution is continuously withdrawn from this body. Adsorbent is added to the column above the bed, either dry or as a slurry, the rate of addition and column length being such as to ensure removal of floc-forming material well before the top of the adsorbent column is reached. It is withdrawn as a slurry from the bottom of the column.

(*B*) A similar process to the above is covered, but instead of a single column a number of carbon filter beds is used, with the sugar solution passing through each in series. The floc-forming material in the effluent from each filter is checked and a fresh bed added to the series as the break-through point is reached with the last bed. The first bed, containing carbon substantially saturated with floc-forming material, is then taken out of the series.

[1] *I.S.J.*, 1960, **62**, 76.
[2] *I.S.J.*, 1960, **62**, 294.

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Bulk sugar trucks. Leyland Motors Ltd., Leyland, Lancs.; Carmichael & Sons (Worcester) Ltd., The Butts, Worcester.

The bulk sugar tanker illustrated is one of a number supplied to the British Sugar Corporation Ltd. The Carmichael body is mounted on a Leyland Octopus chassis and can hold 14 tons of sugar. It is fitted with Edbro 4LNS tipping gear for gravity discharge and with a Godfrey L675 blower for pneumatic discharge.

* * *

The Gruendler cane trash disintegrator. Gruendler Crusher and Pulveriser Co., 2915 North Market, St. Louis 6, Mo., U.S.A.

Disintegrated cane trash is produced by this machine which is mounted on a tractor-drawn trailer, and driven either from the tractor p.t.o. or by a standard power unit mounted on the trailer. One man feeds the trash left after harvesting into the entry port, where it is automatically drawn in and subjected to the action of a disintegrator head fitted with four adjustable and easily replaceable blades. The cylinder is carefully balanced to reduce vibration, and is provided with bearings mounted outboard of the welded steel housing. After processing the fragments are forcibly blown out through an overhead front-, rear- or side-discharge flue so that it is scattered on the ground ready for ploughing-in. In this state it is readily decomposed to enrich the soil and does not provide a haven for cane borers.

* * *

Temperature indicator-controller. Fielden Electronics Ltd., Wythenshawe, Manchester.

A new inexpensive Temperature Indicator-Controller is housed in a 6 in diameter panel mounting case and has a 13 in scale calibrated in °C or °F in any of 73 standard ranges for temperatures between —200° and 850°C (—330° to 1550°F). The platinum resistance measuring bulb is housed in a $\frac{1}{4}$ in stainless steel sheath and can be located from zero to 300 ft from the instrument, the distance having no effect on performance. The control point is set by a knob in the centre of the dial while the indicating pointer is motor-driven from a servo system. The instrument is completely transistorized for reliability and operates from 12 volts D.C. or mains supply. Calibration accuracy is $\pm$ 0·5% of the scale and repeatability is 0·25°C on most ranges.

* * *

PUBLICATIONS RECEIVED

GAPMETERS. G. A. Platon Ltd., 281 Davidson Road, Croydon, Surrey.

Attributes of the Gapmeter range of flowmeters for liquids or gases are that they are small, accurate, simple, inexpensive, easy to read and adaptable. They are available in 25 sizes and can measure from 0·1 g.p.h. to 800 g.p.h. when calibrated for water or 0·1 to 100 cu.ft./hr for air. All may be fitted with the "Flo-Scan" photo-transistor alarm switch.

* * *

INSTRUMENTS FOR DRAUGHT AND PRESSURE. Cambridge Instrument Co. Ltd., 13 Grosvenor Place London S.W.1.

List 47/1 provides a comprehensive eight-page catalogue of the Cambridge draught and pressure indicators, recorders and controllers together with accessories. Illustrations of the various dials and charts available are included as well as tables of reference numbers, ranges, weights and dimensions, etc.

* * *

"DRICOTE". Croda Ltd., Cowick Hall, Snaith, Goole, Yorkshire.

"Dricote" is a grease-free temporary rust preventative which can be painted over. It is a composition of plastic materials, etching chemicals and solvents which is handleable 15–30 minutes after application and is hard dry after 30–40 minutes. It protects the metal against rust or corrosion and also etches it, preventing spread of corrosion.

* * *

"ABAVIT S6". British Schering Ltd., 229 Kensington High Street, London W.8.

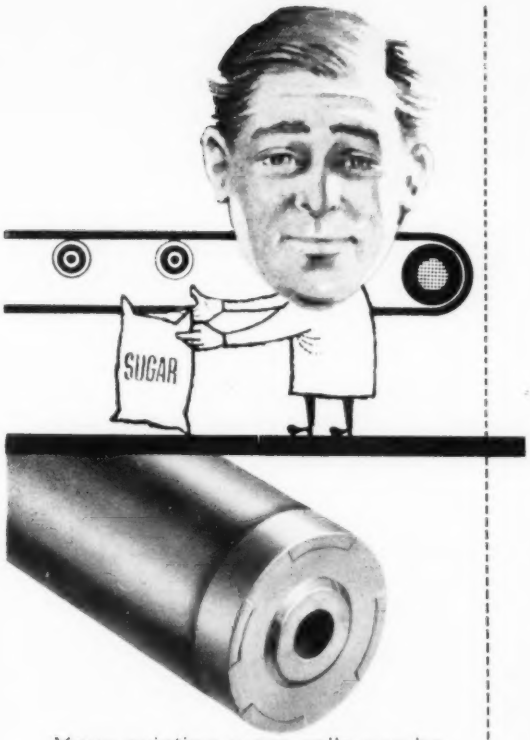
"Abavit S6," a readily soluble powder, is an organo-mercurial fungicide specially prepared as a disinfectant dip to control soil-borne diseases of sugar cane. A particular application mentioned in a new leaflet is the treatment of setts for the prevention of pineapple disease and to ensure good germination.

* * *

British automatic controls for the U.S.S.R. The Nikolaevskii sugar beet factory in Russia is to be equipped with £30,000 of automation equipment supplied by Honeywell Controls Ltd., of Greenford, Middlesex. The equipment will provide continuous automatic control from diffuser to thick juice and subsequent batch control. A graphic panel of miniature and full size instruments will control flow, temperature, pressure, liquid level, lime demisty and concentration of the juice. Honeywell have received a similar £6000 order for the Shiraz sugar factory in Persia.

* * *

Farrel-Birmingham Co. Inc. 1960 report. Sugar machinery sales activity has increased substantially in areas of the world seeking to expand their sugar production due to the unsettled Cuban situation. During the year a large sugar mill tandem was shipped to the Philippine Islands and an even larger tandem for Argentina is in production together with two individual mills for Panama. Future activity in Latin America is evident and several new factories are being negotiated to be constructed in cooperation with Sucesores de Abarca of San Juan, Puerto Rico. Farrel has been selected by the United States Sugar Corporation as prime contractor for the construction of a complete raw sugar factory in Bryant, Florida.



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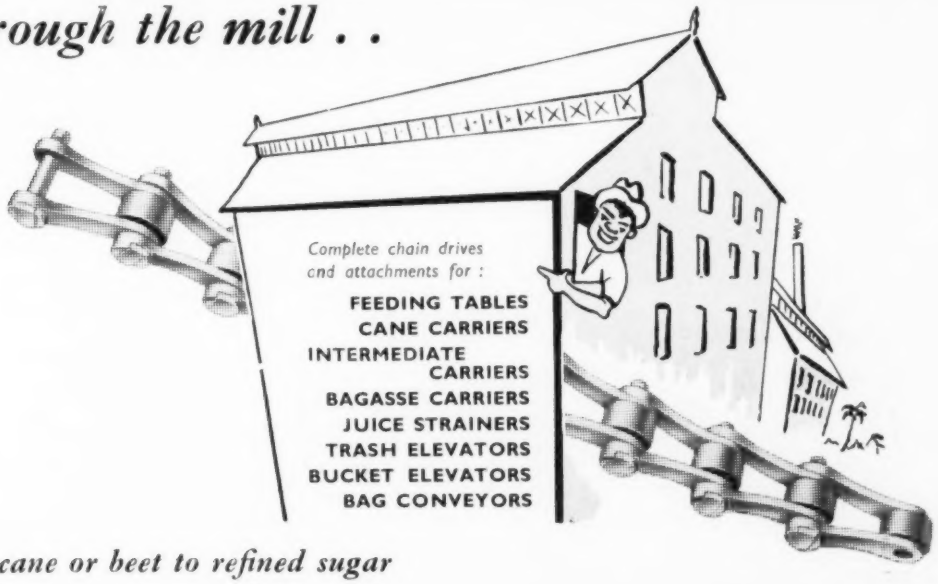

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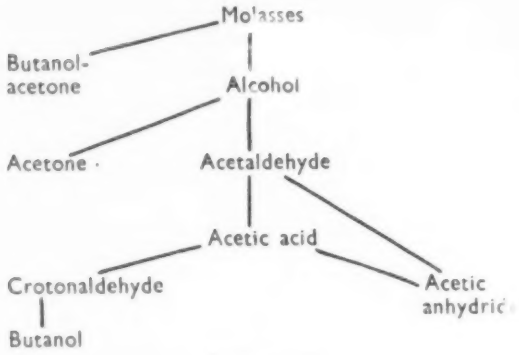

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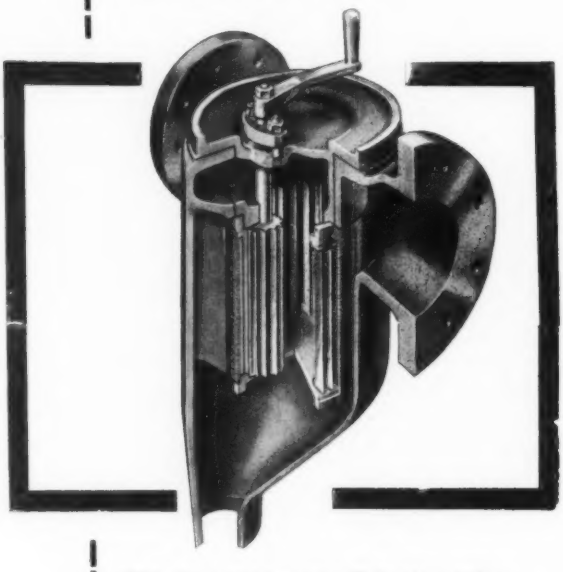

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SUGAR CROPS OF THE WORLD

WILLETT & GRAY'S CROP ESTIMATES[1]

(1) CANE SUGAR

	Harvesting Period	LONG TONS		SHORT TONS		METRIC TONS	
		1960/61	1959/60	1960/61	1959/60	1960/61	1959/60
U.S.—Louisiana	Oct.–Jan.	415,000	393,214	464,800	440,400	421,661	399,525
Florida	Oct.–Apr.	165,000	150,000	184,800	168,000	167,648	152,408
Puerto Rico	Jan.–June	1,025,000	898,600	1,148,000	1,006,432	1,041,450	913,023
Hawaiian Islands	Jan.–Dec.	980,000	908,344	1,097,600	1,017,345	995,729	922,923
Virgin Islands	Jan.–June	13,000	6,125	14,560	6,860	13,209	6,223
Cuba	Jan.–June	5,000,000	5,768,000	5,600,000	6,460,160	5,080,250	5,860,576
British West Indies—Trinidad	Jan.–June	190,000	217,919	212,800	244,069	193,050	221,417
Barbados	Jan.–June	148,000	153,668	165,760	172,108	150,375	156,134
Jamaica	Jan.–June	454,950	426,608	509,544	477,801	462,252	433,455
Antigua	Jan.–June	25,000	20,021	28,000	22,424	25,400	20,342
St. Kitts	Feb.–Aug.	50,000	49,717	56,000	55,683	50,802	50,515
Other B.W.I.	Jan.–June	10,000	9,067	11,200	10,155	10,160	9,213
French West Indies—							
Martinique	Jan.–July	80,000	78,000	89,600	87,360	81,284	79,252
Guadeloupe	Jan.–July	150,000	147,000	168,000	164,640	152,408	149,359
Dominican Republic	Jan.–July	1,231,248	902,704	1,378,998	1,011,028	1,251,010	917,192
Haiti	Dec.–June	62,500	58,709	70,000	65,754	63,503	59,650
Mexico	Nov.–Oct.	1,590,000	1,550,000	1,780,800	1,736,000	1,615,520	1,574,878
Central America—Guatemala	Jan.–June	80,000	67,500	89,600	75,600	81,284	68,583
Salvador	Nov.–Mar.	52,000	50,000	58,240	56,000	52,835	50,803
Other North and Central America	Jan.–June	200,000	190,000	224,000	212,800	203,210	193,050
South America—							
British Guiana	Oct.–June	335,000	332,500	375,200	372,400	340,377	337,837
Colombia	Oct.–June	330,000	299,910	369,600	335,900	335,297	304,724
Venezuela	Oct.–June	205,000	180,000	229,600	201,600	208,290	182,889
Ecuador	June–Jan.	105,000	99,700	117,600	111,664	106,685	101,300
Peru	Jan.–Dec.	770,000	692,730	862,400	775,858	782,359	703,848
Argentina	May–Oct.	680,000	900,000	761,600	1,008,000	690,914	914,445
Brazil	June–May	3,375,000	3,140,000	3,780,000	3,516,800	3,429,169	3,190,397
Other South America	Jan.–Dec.	150,000	125,000	168,000	140,000	152,408	127,006
TOTAL AMERICA		17,871,698	17,815,036	20,016,302	19,952,841	18,158,539	18,100,967
India & Pakistan (Gur)	Dec.–May	3,000,000	3,300,000	3,360,000	3,696,000	3,048,150	3,352,965
do. (White)	Oct.–July	3,100,000	3,000,000	3,472,000	3,360,000	3,149,755	3,048,150
Indonesia	May–Nov.	750,000	800,000	840,000	896,000	762,038	812,840
Japan	Oct.–Mar.	141,500	137,292	158,480	153,767	143,771	139,495
Taiwan	Oct.–May	880,000	758,740	985,600	849,788	894,124	770,918
Philippine Islands	Sept.–Aug.	1,390,000	1,365,030	1,556,800	1,528,834	1,412,310	1,386,939
Other Countries		1,100,000	1,066,000	1,232,000	1,193,920	1,117,655	1,083,109
TOTAL ASIA		10,361,500	10,427,062	11,604,880	11,678,309	10,527,802	10,594,416
Australia	June–Nov.	1,330,000	1,288,477	1,489,600	1,443,094	1,351,346	1,309,157
Fiji Islands	June–Nov.	195,000	180,000	218,400	201,600	198,130	182,889
TOTAL AUSTRALIA & POLYNESIA		1,525,000	1,468,477	1,708,000	1,644,694	1,549,476	1,492,046
Egypt	Jan.–June	306,000	295,000	342,720	330,400	310,911	299,735
Mauritius	June–Jan.	235,000	571,044	263,200	639,569	238,772	580,210
Réunion	Aug.–Jan.	220,000	215,000	246,400	240,800	223,530	218,451
Natal and Zululand	May–Apr.	940,000	1,062,051	1,052,800	1,189,497	955,087	1,079,097
Mozambique	May–Dec.	170,000	165,000	190,400	184,800	172,729	167,648
Angola	May–Oct.	57,000	56,000	63,840	62,720	57,915	56,899
British East Africa*	Sept.–Aug.	135,000	130,000	151,200	145,600	137,167	132,086
Other Africa		180,000	175,000	201,600	196,000	182,889	177,809
TOTAL AFRICA		2,243,000	2,669,095	2,512,160	2,989,386	2,279,000	2,711,935
Total Cane Sugar Crops		**32,001,198**	**32,379,670**	**35,841,342**	**36,265,230**	**32,514,817**	**32,899,364**

[1] Dated: 26th January 1961.

SUGAR CROPS OF THE WORLD

(continued)

(2) BEET SUGAR

	Harvesting Period	Long Tons 1960/61	Long Tons 1959/60	Short Tons 1960/61	Short Tons 1959/60	Metric Tons 1960/61	Metric Tons 1959/60
Europe—Germany	Sept.–Jan.	2,620,000	2,035,000	2,934,400	2,279,200	2,662,050	2,067,662
Czechoslovakia	Sept.–Jan.	1,000,000	715,000	1,120,000	800,800	1,016,050	726,476
Hungary	Sept.–Jan.	440,000	385,000	492,800	431,200	447,062	391,179
France	Sept.–Jan.	1,500,000	1,060,000	1,680,000	1,187,200	1,524,075	1,077,013
Belgium	Sept.–Jan.	340,000	215,000	380,800	240,800	345,457	218,451
Holland	Sept.–Jan.	550,000	490,000	616,000	548,800	558,828	497,865
Russia & Ukraine	Sept.–Jan.	6,000,000	5,500,000	6,720,000	6,160,000	6,096,300	5,588,275
Poland	Sept.–Jan.	1,500,000	975,000	1,680,000	1,092,000	1,524,075	990,649
Sweden	Sept.–Jan.	290,000	280,000	324,800	313,600	294,655	284,494
Denmark	Sept.–Jan.	247,000	245,000	276,640	274,400	250,964	248,932
Italy	Aug.–Oct.	1,000,000	1,420,000	1,120,000	1,590,400	1,016,050	1,442,790
Spain	July–Feb.	468,000	498,875	524,160	558,740	475,511	506,882
Switzerland	Sept.–Jan.	30,000	42,000	33,600	47,040	30,482	42,674
Bulgaria	Sept.–Jan.	215,000	160,000	240,800	179,200	218,450	162,568
Roumania	Sept.–Jan.	345,000	343,000	386,400	384,160	350,537	348,505
Great Britain*	Sept.–Jan.	600,000	773,292	672,000	866,087	609,630	785,703
Ireland*	Sept.–Jan.	100,000	130,000	112,000	145,600	101,605	132,086
Jugoslavia	Sept.–Jan.	265,000	280,000	296,800	313,600	269,253	284,494
Turkey*	Sept.–Jan.	515,000	515,000	576,800	576,800	523,266	523,266
Other Europe	Sept.–Jan.	350,000	350,000	392,000	392,000	355,618	355,618
Other countries		450,000	420,000	504,000	470,400	457,223	426,741
TOTAL		18,825,000	16,832,167	21,084,000	18,852,027	19,127,141	17,102,323
United States—Beet*	July–Jan.	2,160,000	1,912,999	2,419,200	2,142,559	2,194,668	1,943,702
Canada—Beet*	Oct.–Dec.	116,000	125,400	129,920	140,448	117,862	127,413
Total Beet Sugar Crops		**21,101,000**	**18,870,566**	**23,633,120**	**21,135,034**	**21,439,671**	**19,173,438**
Grand Total—Cane and Beet		**53,102,198**	**51,250,236**	**59,474,462**	**57,400,264**	**53,954,488**	**52,072,802**

* Refined.

BREVITIES

Danish beet sugar industry reorganization dropped[1].—Following talks between A/S De danske Sukkerfabrikker and the Danish Ministry of Commerce, a new agreement extending to the 30th April 1971 has been reached and plans for reorganization[2] have been dropped.

* * *

Erratum. In our abstract of "Analysis of beet marc in connexion with pressing quality of exhausted pulp" by R. CAROLAN[3], we reported that the results of pectin analysis were low, possibly owing to the high moisture content of the pressed pulp. In fact, these results were based on dry marc, and it is the high moisture content which it is thought might be attributable to the low pectin content instead of *vice-versa*.

* * *

Czarnikow century. March 1961 marked the Centenary of the founding of C. Czarnikow Ltd., sugar brokers. On the 1st March 1861, Mr. Caesar Czarnikow commenced business on his own account having been admitted a broker by the Court of the Lord Mayor and Aldermen of the City of London. We offer our congratulations to this important and highly-esteemed firm, whose *Sugar Review* is one of the most reliable sources of information and comment on the sugar trade.

* * *

Bagasse paper in Argentina[4].—The Export-Import Bank in Washington has authorized the lending of $9,100,000 to Ledesma S.A. Industrial of Argentina which will be used to buy U.S. equipment and services to construct a bagasse pulp and paper mill. The bagasse would be supplied by Ledesma's sugar mills and the new plant is espected to produce pulp and paper at the rate of 100 tons a day when in production in 1963. Repayments will be made over seven years after the plant has begun to manufacture paper.

Dutch beet crop, 1960/61[5].—The 1960/61 sugar beet crop in Holland has yielded 4,676,000 tons of roots, an increase of more than 50% over outturn in the previous campaign.

* * *

Barbados bulk loading commences[6].—The first commercial vessel to receive sugar in bulk received 2500 tons of sugar on the 11th March at the new Bridgetown terminal. Loading took 5 hours compared with 3 days which would have been necessary with bagged sugar.

* * *

Hungarian sugar crop, 1960/61.—In mid-February Hungary's eleven sugar factories finished their longest-ever campaign which started in early September, 3,374,000 tons being sliced to yield 93,000 tons more sugar than planned. Last year 352,850 tons of sugar were made.

* * *

Canadian 1960 beet crop[7].—In the 1960 sugar beet harvest some 211,100 tons of beets were harvested from 14,258 acres, an average of 14·8 tons per acre. The sugar content averaged 16·5%. Mechanical harvesters were used for 80% of the crop, and good weather has resulted in a low dirt tare of 4·9% as compared with an average of 6–7% and last year's tare of 9·8%.

[1] C. Czarnikow Ltd., *Sugar Review*, 1961, (498), 54.
[2] *I.S.J.*, 1961, **63**, 63.
[3] *I.S.J.*, 1961, **63**, 91–92.
[4] *The Times*, 17th February 1961.
[5] C. Czarnikow Ltd., *Sugar Review*, 1961, (489), 14.
[6] *The Times*, 13th March 1961.
[7] *Willett & Gray*, 1960, **84**, 491.

Sir OLIVER LYLE

The death on 21st February of Sir OLIVER LYLE was a great loss to the technical ranks of our sugar industry. Endowed with talents in many fields, with limitless curiosity, energy and tenacity of purpose, O. L. in his later years became one of our finest teachers. His name will endure with those of VON LIPPMAN, CLAASSEN, PRINSEN GEERLIGS, BROWN, MEADE, DEERR and ZERBAN.

OLIVER LYLE was borne on 22nd December, 1890 at Weybridge. His father, JOHN LYLE, and his grandfather, ABRAM LYLE, were sugar refiners before him. He was educated at Uppingham and the University of London.

He joined Abram Lyle & Sons in 1912 and on his return to civilian life in 1919 he set about training himself in every aspect of refinery operations. He was appointed to the Board of Abram Lyle & Sons in that year. Two years later, on the amalgamation of Henry Tate & Sons and Abram Lyle & Sons, he and his elder brother Philip were appointed Joint Managing Directors of Plaistow Wharf Refinery. This partnership was strikingly successful. Mr. PHILIP LYLE's interests in mathematics and applied science were most happily combined with O. L.'s capacity in engineering and technology, and the two brothers rapidly laid the foundations for the improvements in unit operations which resulted in Plaistow Wharf achieving an international reputation for efficiency and product quality.

During the Hitler war it was possible only to mark time in the refineries and to plan for the future, and it was in this period of enforced inactivity that O. L. turned to education. He wrote first his "Technology for Sugar Refinery Workers" which is now in its third edition and has become a standard work of reference. It is particularly admired for the electrical, optical and thermal illustrations, at which O. L. was a master.

Plaistow Wharf Refinery had specialised in the multiple use of steam and O. L. condensed his knowledge in this field in a second volume "The Efficient Use of Steam". He was a Fellow of the Institute of Fuel and, from 1942 to 1953, a Member of the Fuel Efficiency Committee. For his services in this field he was knighted in 1954.

As a man, O. L. earned respect and affection. Kind and considerate by disposition, his head ruled his heart and he had, when necessary, a tonic astringency. He knew a great deal about his people and their families and very many instances of personal services to his refinery friends passed unknown and unobserved. Sir OLIVER was in fact the first servant of the plant to which he gave most of his life. He set an example of industry and modesty and he will be remembered as an outstanding ornament to the international guild of sugar craftsmen.

F. M. C.

BREVITIES

Ceylon sugar industry expansion[1].—A third sugar cane project at Walawe, in addition to those of Kantalai and Gal Oya, is being planned by the Ceylon Government. The project calls for planting 3000 acres of cane in 1961 and construction of a factory next year.

* * *

New sugar factories for Italy[2].—A sugar factory with a daily processing capacity of 2800 tons of beet is to be built near Crotone, Calabria. It will produce 22,000 tons of refined sugar a year. Another factory is to be built in Sardinia by the "Eridania" sugar group and will be twice the size of the factory at Oristano also owned by "Eridania".

* * *

Sugar expansion in East Africa[3].—Miwani Sugar Mills (Kenya) Ltd., who own a sugar mill of 20,000–25,000 tons of sugar annual capacity, are considering erection of a sugar refinery and expansion of sugar cane cultivation. About £700,000 is to be invested for this purpose. Ramisi Sugar Mills Ltd. will increase the capacity of their sugar factory from 10,000 to 25,000 tons a year, while Uganda Sugar Factory Ltd. wish to erect a sugar factory and to extend cane cultivation provided Colonial Development Corporation Ltd. participation in financing the project can be arranged, since the cost will be about £2,250,000.

New sugar refinery for Angola[4].—A new $8 million sugar refinery is to be established in Luanda by Companhia Açucareira de Cuanza. It will be situated on the Cuanza river near Muxima on a plantation of 37,000 acres. Cane will be grown on about one third of the land and is expected to produce about 45,000 short tons of sugar annually. When the Cambambe hydropower dam now under construction is completed, the refinery will obtain its electric power from that source.

* * *

Sugar production in Finland[5].—Production of sugar beet in the 1960/61 campaign in Finland amounted to 431,507 tons, a record quantity as compared with 272,034 tons outturned in the previous season. The average yield per hectare this campaign was 28·10 tons, 8·93 tons more than in the 1959/60 crop, but the average sugar content was only 11·11% against 14·08% in the preceding crop. The quantity of beet grown in Denmark under contract from Finland totalled 79,259 tons from which 9270 tons of sugar were manufactured, which brought total outturn this season to 57,210 tons, 14,263 tons more than was produced from the 1959/60 crop.

[1] *Willett & Gray*, 1960, **84**, 514.
[2] *Willett & Gray*, 1960, **84**, 532.
[3] F. O. Licht, *International Sugar Report*, 1961, **93**, (Supp. 1), 13.
[4] *Willett & Gray*, 1961, **85**, 28.
[5] C. Czarnikow Ltd., *Sugar Review*, 1961, (491), 23.

BREVITIES

U.S.S.R. beet crop.[1]—According to *die Wirtschaft des Ostblocks*[1], a total of almost 57 million tons of beet were harvested in the 1960/61 campaign, of which over 31 million tons came from the Ukraine. It is supposed that deliveries to the factories would total about 54 million tons, compared with 41·4 million tons in 1959/60.

* * *

Sugar expansion in Turkey[2].—In addition to its 15 sugar factories, Turkey has four further beet factories under construction at Kastomonu, Edirne, Usak and Etimesgut, a suburb of Ankara. Construction of a cane sugar factory at Adana was begun recently but was stopped before completion because of the high cost of sugar production and the monetary situation in the country.

* * *

West German sugar production, 1960/61[3].—Production of sugar from beet in West Germany amounted to 1,777,000 tons against 1,264,500 tons in the previous campaign, according to the West German Ministry of Food. The campaign, which ended on the 16th January, produced some 12,800,000 tons of beet for processing from an area of about 299,800 hectares, compared with 8,645,500 tons from 295,355 hectares previously. The yield per hectare was 42·7 tons and the sugar content was 16·11% on beet. A further 15,000 tons of sugar were produced from molasses.

Stock Exchange Quotations

London Stocks (*at 17th March*, 1961)	CLOSING MIDDLE
Anglo-Ceylon (5s)	14/3
Antigua Sugar Factory (£1)	11/3
Booker Bros. (10s)	31/–
British Sugar Corp. Ltd. (£1)	24/6
Caroni Ord. (2s)	4/1½
Caroni 6% Cum. Pref. (£1)	15/–
Distillers Co. Ltd. (10s units)	36/9
Gledhow Chaka's Kraal (£1)	40/–
Hulett & Sons (£1)	58/9
Jamaica Sugar Estates Ltd. (5s units)	4/–
Leach's Argentine (10s units)	25/–
Manbré & Garton Ltd. (10s)	67/–
Reynolds Bros. (£1)	38/9
St. Kitts (London) Ltd. (£1)	20/3
Ste. Madeleine (Ord.) (£1)	28/–
Sena Sugar Estates Ltd. (10s)	12/9
Tate & Lyle Ltd. (£1)	53/–
Tate & Lyle Investments Ltd. (5s)	16/4½
Trinidad Sugar (5s stock units)	44/6
United Molasses (10s stock units)	40/–
West Indies Sugar Co. Ltd. (£1)	18/–

New York Stocks (*at 16th March*, 1961)	CLOSING MIDDLE $
American Crystal ($10)	41¼
Amer. Sugar Ref. Co. ($25)	32⅜
Central Aguirre ($5)	24
Cuban American ($10)	17¾
Great Western Sugar Co.	31⅜
South P.R. Sugar Co.	16½
United Fruit Co.	24¼

Sugar Industry Technicians Inc.

THE 20th Annual Meeting of Sugar Industry Technicians Inc. will be held in New York during the 7th–9th May. Guest of Honour will be the Hon. ELLSWORTH BUNKER, U.S. Ambassador to India, who, prior to his appointment as Ambassador to Italy in 1951, was a leading figure in the U.S. sugar refining commumity as a Director of sugar companies operating in the U.S., Puerto Rico, Cuba and Mexico, as well as Chairman of the Cane Sugar Refiners' War Committee during World War II.

Papers are to be presented by representatives of Tate & Lyle Ltd. and the British Sugar Corporation as well as of American companies. Other papers are to be presented by workers from Canada, Australia, and the Philippines, a list being given below. It is anticipated that abstracts of the papers will appear in this *Journal* in due course.

1. Use of Granular Carbon at C. & H.—N. L. PENNINGTON & R. S. PATTERSON (California & Hawaiian Sugar Refining Corporation, U.S.A.)

2. The Production of Bottlers' Sugar, using a Rapid Polarographic Test for Assessing Suitability—D. HIBBERT, T. LANGHAN, W. WALKER and G. WILSON (British Sugar Corporation Ltd, England.)

3. A New White Sugar Building in London—FRANK M. CHAPMAN (Tate & Lyle Ltd., England).

4. Some Methods of Defecation and Clarification of Affination Syrup—G. E. WARING (Atlantic Sugar Refineries Ltd, Canada).

5. The Bulk Density of Granulated Sugar and other Factors affecting the Specification of Package Dimensions—R. E. ROBERTS and A. M. HERTZBERG (Colonial Sugar Refining Co. Ltd., Australia).

6. Refining of High Purity Washed Sugar without Affination—MANUEL V. LOCSIN (Victorias Milling Co., Inc., Philippines).

7. Carbonatation at the Savannah Sugar Refinery—J. W. ALBERINO, Jr. (Savannah Sugar Refining Corporation, U.S.A.).

8. Adsorption by Bone-Black, using a Continuous Adsorption Process—Dr. W. MARCY (American Sugar Refining Company, U.S.A.).

9. Bulk Raw Sugar Handling by Rail—L. K. DAVIS (Pennsylvania Sugar Div. National Sugar Refining Company, U.S.A.).

10. Pan Operation at the Reserve Refinery—B. A. OXNARD, Jr. (Reserve Div., National Sugar Refining Company, U.S.A.).

11. Moisture Analysers—H. J. REICHE and JOSEPH F. DOWLING (Refined Syrups & Sugars, Inc., U.S.A.).

12. Development of a New Auto-Analyzer Method for Continuous Measurement of Sugar in Refinery Waste Water in the Presence of Interfering Agents—J. V. CONGDON and S. B. ZAIATZ (Revere Sugar Refinery, U.S.A.).

13. Treatment of Raw Sugar Samples before Analysis—F. BERGER and W. W. BINKLEY (New York Sugar Trade Laboratory, Inc., U.S.A.).

14. SYMPOSIUM: Instrumentation and Vacuum Pan Control in Sucrose Crystallization.

Moderator: E. DWIGHT GILLETTE.

Panel: ARMANDO ABAY—American Sugar Refining Company; Dr. PIETER HONIG—Elmsford, New York; Dr. P. F. MEADS—California & Hawaiian Sugar Refining Corp.; J. N. NOGATCH—National Sugar Refining Company; PETER H. PETRI—Refined Syrups & Sugars, Inc.

[1] Through C. Czarnikow Ltd., *Sugar Review*, 1961, (489), 14.
[2] *Willett & Gray*, 1961, **85**, 45.
[3] *Public Ledger*, 11th February 1961.

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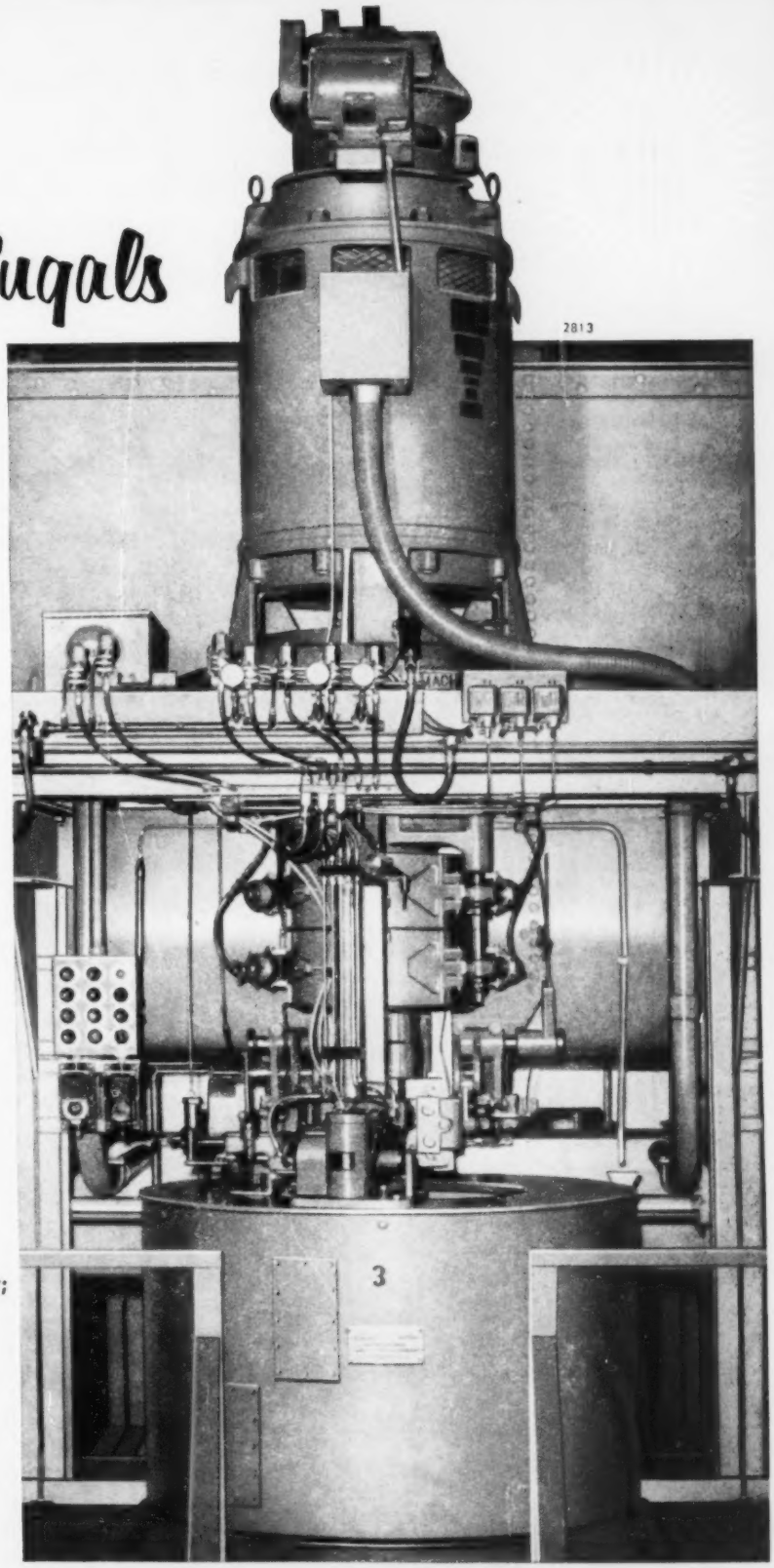

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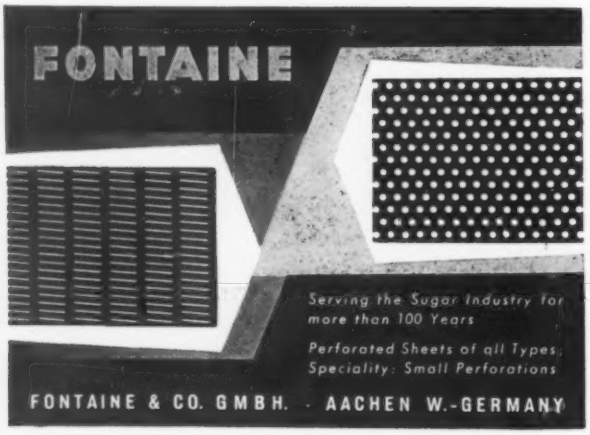
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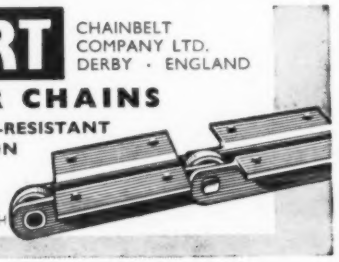

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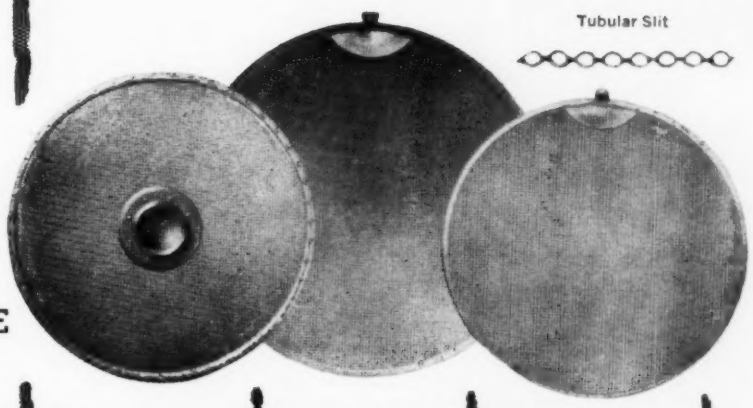

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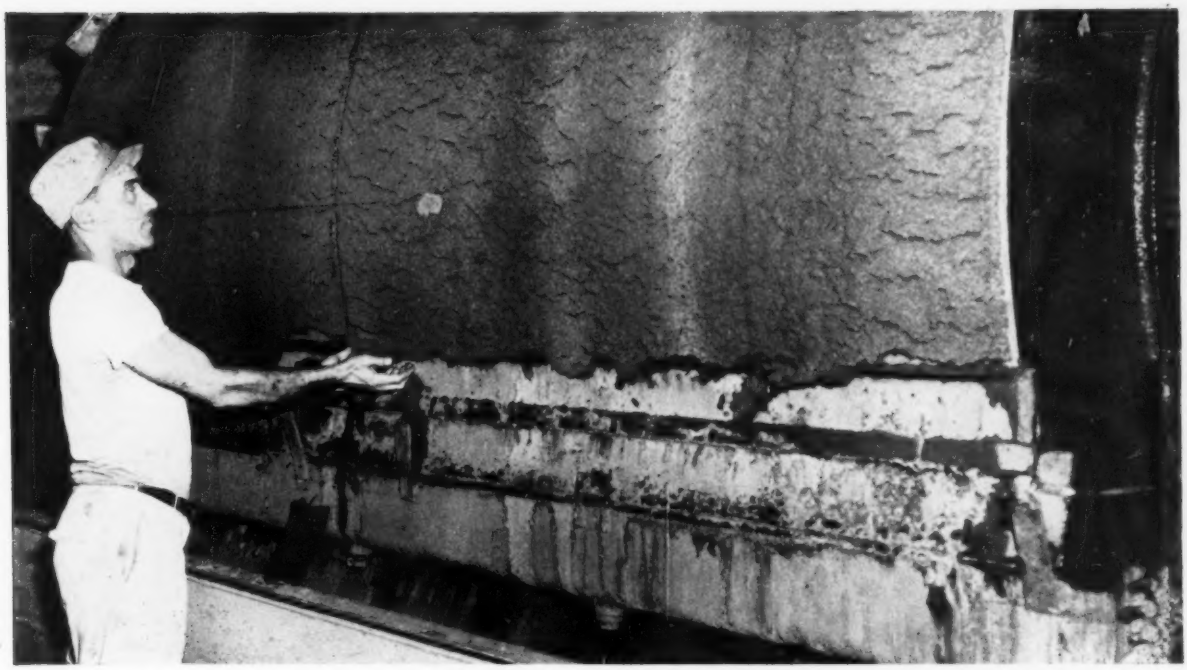

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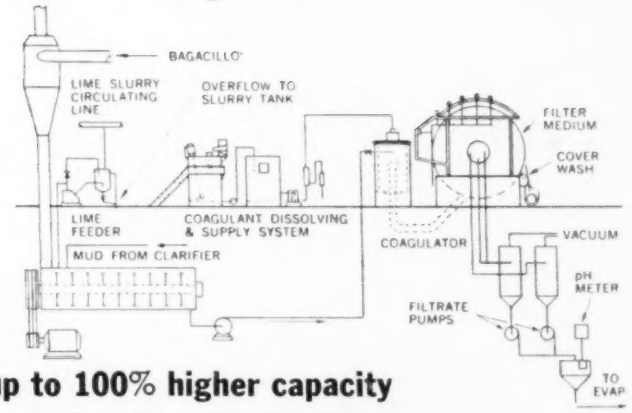

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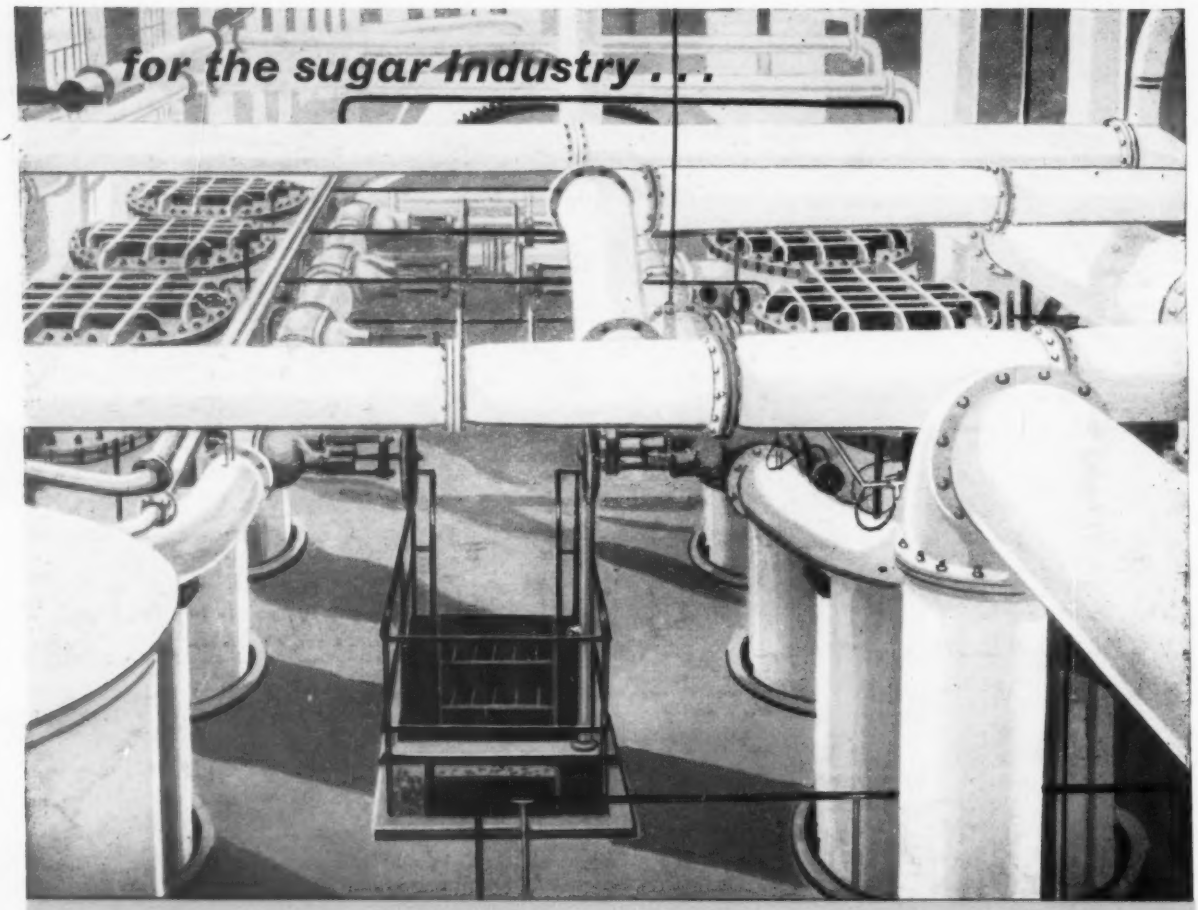
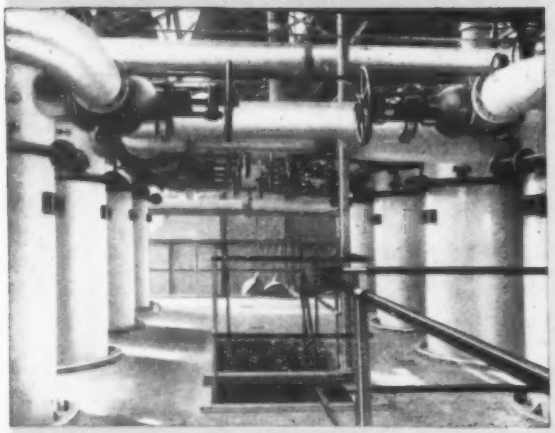


FLETCHER JUICE HEATERS



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